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CANADIAN ELECTRONICS ENGINEERING

MAR 20 1961

featuring
the latest
Canadian
developments
in components,
instruments
and equipment

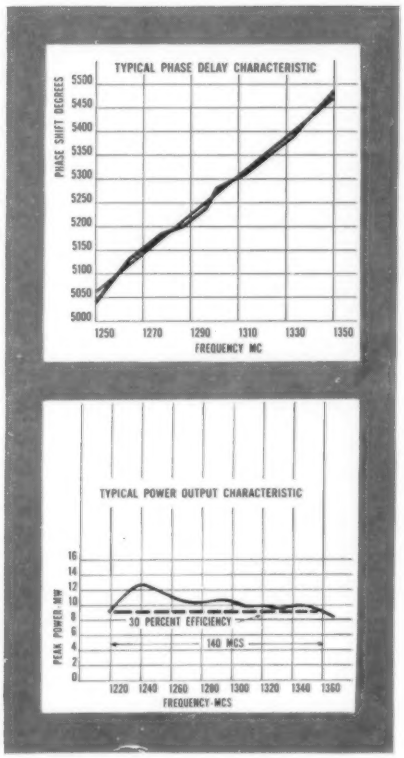
New Broadband Klystrons

140 MEGACYCLES - (1db) BANDWIDTH AT L-BAND
10 MEGAWATTS - PEAK POWER OUTPUT

New additions to the Litton Industries Broadband Klystron family extend broadband performance to even higher power levels as shown in the typical performance curves to the right. These tubes, like all those produced by Litton Industries, are conservatively designed and rated; and rigorously processed to provide many thousands of hours of reliable operation. Using Litton developed broadbanding techniques, it is now possible to achieve wide bandwith, high peak and average rf power output and linear phase shift versus frequency characteristics simultaneously. This latter feature enables the radar equipment designer to utilize pulse compression techniques to attain improved system performance.

Litton Klystrons providing these outstanding performance characteristics can be supplied in both the L and S-bands at peak rf power levels ranging from 2 to 20 megawatts. Typical of the performance obtained with Litton Klystrons is that of the L-3035, a 2.2 megawatt L-band Klystron, whose average operating life in field service is approaching 3,000 hours. Some of these tubes are continuing to provide excellent service after having operated for more than *17,000* hours.

Should you require high power broadband amplifier tubes to satisfy your system requirements, please write to us at Litton Industries, Electron Tube Division, 960 Industrial Road, San Carlos, California. Our telephone number is LYtell 1-8411.



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For further information mark No. 48 on Readers' Service Card

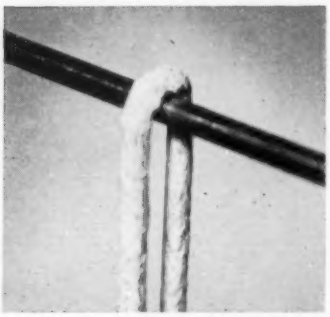
CANADIAN ELECTRONICS ENGINEERING

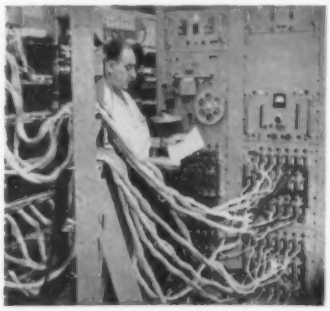
Volume five number **3** **March 1961**

Why not look into export possibilities? Editorial comment **37**

New products review **38**

CEE's annual review of new products this year features a special report on the latest Canadian developments in components, instruments and equipment.





International Conference:
Scientists discuss nuclear structure **48**

Canada played host to physicists from more than twenty-four countries when the International Conference on Nuclear Structure was held at Queen's University, Kingston, Ontario last fall. The conference was organized by physicists from Queen's and Atomic Energy of Canada Ltd.

Dr. H. E. Gove is head of the Nuclear Physics Branch of AECL. He is seen here welcoming Prof. A. D. Komar of the Physical Technical Institute, Leningrad, Soviet delegation head.

Cascaded transistors produce high voltage pulses **51**

This report describes a method of cascading type p-n-p transistors to produce steep-front positive pulses of any desired amplitude. The circuit produces pulses of 100 volts amplitude, with rise times of 0.05 usec and fall times of 0.5 usec.

F. C. Creed joined the National Research Council in 1945 after graduating in electrical engineering from Queen's. He was given two years' leave of absence in 1950 to study at Queen Mary College, University of London, where he obtained his PhD in electrical engineering in 1952. Dr. Creed's main field of work is high voltage; he is currently engaged in the development of a new oscilloscope for impulse voltage recording.

CONTENTS — continued on page 3

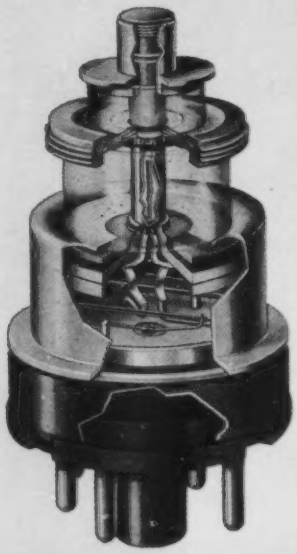
PHILIPS

REFERENCE BULLETIN NO. 4

EC157 Disk Sealed Triode guaranteed for 6000 hours

The EC157 triode serves as an amplifier tube in beam transmitter relay stations for the transmission of TV and telephony link broadband signals at 4000 mc/s. Station breakdowns in microwave communications are costly in time and money. The EC157, with a *guaranteed life of 6000 hours*, assures against early breakdowns, saves time and money. Its longer life means a more reasonable operating cost – *not more than 2.3¢ per hour of service.*

The EC157 triodes offer many desirable features – peak performance, dependable service and outstanding uniformity from tube to tube.



TECHNICAL DATA

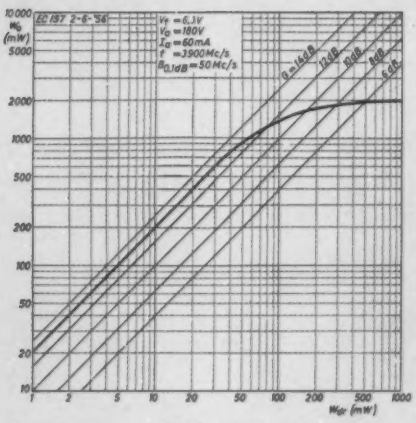
HEATER	V_h = 6.3 V					
	I_h = 0.73 A					
TYPICAL CHARACTERISTICS		nom.	min.	max.	nom.	
Anode voltage	V_a =	180	–	–	180	V
Anode current	I_a =	30	–	–	60	mA
Grid voltage	V_g =	–2.8	–4.0	–1.8	–1.6	V
Mutual conductance	S =	17	13.5	–	19	mA/V
Amplification factor	μ =	43	33	52	43	

OPERATING CONDITIONS AS GROUNDED GRID AMPLIFIER AT 4000 Mc/s

Anode supply voltage	V_{ba} =	200 V
Grid supply voltage	V_{bg} =	+20 V
Cathode bias resistor	R_k =	max. 500 Ω
Anode current	I_a =	60 mA
Bandwidth (0.1 dB down)	B =	50 Mc/s
Output power at 8 dB power gain (V_f = 6.3 V)	W_o =	1.8 W (min. 1.5 W)

MAXIMUM RATINGS (absolute maxima)

Anode voltage at zero anode current	V_{ao} =	500 V
Anode voltage	V_a =	300 V
Anode dissipation	W_a =	10 W
Cathode current	I_k =	70 mA
Grid current	I_g =	10 mA
Driving power (grounded grid)	W_{dr} =	1 W
Direct grid voltage (positive)	V_g =	0 V
Direct grid voltage (negative)	V_g =	–50 V
Heater to cathode voltage	V_{kf} =	50 V
External resistance between cathode and heater	R_{kf} =	20 kΩ
External resistance between grid and cathode	R_{gk} =	25 kΩ
Anode seal temperature	t_a =	150 °C
Grid seal temperature	t_g =	75 °C
Cathode seal temperature	t_k =	75 °C



Output power (W_o) of the EC157 as a function of the driving power (W_{dr}) with lines of constant power gain (G); (f = 3900 Mc/s. $B_{0.1\ dB}$ = 50 Mc/s, V_a = 180 V, I_a = 60 mA).

This reference sheet is one of a series from Philips to keep you fully informed of electronic developments. A specially designed file folder for these bulletins is available from Philips on request.

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PHILIPS

Professional Tubes, Semiconductors & Components Dept

PHILIPS ELECTRONICS INDUSTRIES LTD

116 Vanderhoof Avenue, Toronto 17, Ontario, Canada

For further information mark No. 64 on Readers' Service Card

CONTENTS — continued from page 1

Patent news

This new department will include descriptions of Canadian inventions, many of which are available for licensing.

In this issue: Dr. Lloyd V. Berkner, president of IRE, to address 1961 IRE Canadian Electronics Conference banquet. Electronic Industries Association of Canada represented on executive of IRE Canadian Electronics Conference. Montreal Section to hold second symposium in November, 1962. News from the sections. **52**

IRE News

Another new department of CEE that will carry news of Institute of Radio Engineers activities across Canada.

The information contained in "Patent news" has been prepared by Canadian Patents and Development Limited, the crown company responsible for licensing inventions made by government personnel. Enquiries should be sent to Mr. J. R. Johnson, chief of the Development and Promotion Section, 100 Sussex Drive, Ottawa 2, Ontario. **56**

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CANADIAN ELECTRONICS ENGINEERING

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Indexed in Engineering Index.

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450 to 1050 Mc

Type 1361-A Oscillator.....$285.

- Butterfly Tuning Circuit — no sliding contacts
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- Small Size: 8″ x 7″ x 8¼″; only 7 lbs.
- Power Supply Recommended: 1201-A Regulated Power Supply $85, for cw; 1263-B Amplitude Regulating Power Supply $355, for constant output level; 1264-A Modulating Power Supply (below).

Type 1361-A Oscillator and Type 1264-A Modulating Power Supply conveniently mount in a relay rack with Adaptor Plates, Type 480-P-416, $6.

NEW MODULATING POWER SUPPLY

. . . for high-level pulse and square-wave modulation of Vhf-Uhf Unit Oscillators.

OUTPUTS: Square Waves — adjustable from 160v to 210v; internally generated 850 to 1150 cps, with high stability; externally generated 20 to 50,000 cps from sine or square-wave source.

Pulses (externally generated) — 160v to 210v at rates up to 100 kc, pulse durations from 1.5 μsec to square wave (determined by external generator), less than 1.5 μsec rise and decay times for typical oscillator load, overshoot less than 5%.

Regulated DC — adjustable from 200v to 300v, 50 ma (max)

Unregulated AC — 6.3v; 2.1a (max)

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Small Size: 7″ x 8″ x 8″; 12 lbs. **Price: $285.**

12 Other Unit Oscillators Cover the Range from 20 cps to 7,425 Mc

See 21 NEW Instruments at the IRE Show including a Counter with a Memory and a new 1000-Mc Frequency Standard.

Booths 3201-3208

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NEWS HIGHLIGHTS

DDP increases funds for some grants to industry, reduces vote for others

The Department of Defence Production has increased the sum available for grants to sustain technological capability in Canadian industry from $5 million to $5.5 million for the coming 1961-62 fiscal year. At the same time reliable sources report that regulations governing the granting of this money will be relaxed. In particular, consideration is being given to allowing sums to be granted, usually on a 50-50 basis with industry, for general research and development work in the defense field, rather than being tied as at present to particular known markets. Under the present regulations the grant has been greatly undersubscribed. Of the $5 million allocated in 1960-61 only $3.1 million will be spent before the end of the financial year.

However, other forms of DDP grants to industry have been considerably reduced. The item listed as "to establish qualified sources for the production of component parts and materials," used mainly to enable companies to buy test equipment in anticipation of expected contracts, has been cut from $950,000 in 1960-61 to $607,000 next year. This sum was also undersubscribed this year — only $625,000 of the $950,000 allocated will be spent. Another vote, intended to assist Canadian firms with tooling and preproduction costs in competition with U. S. firms in the U. S. market, has also been reduced.

The sum for "establishment of productive capacity" remains unchanged at $1,250,000 and that for the purchase of equipment is increased from $293,500 to $340,000 for the coming year. However, an item of $1,188,000 for construction and improvements including acquisition of land is dropped entirely. Officials report that the basic capital costs in this field have already been met.

DND to spend less on electronic equipment, but other departments may buy more during next fiscal year

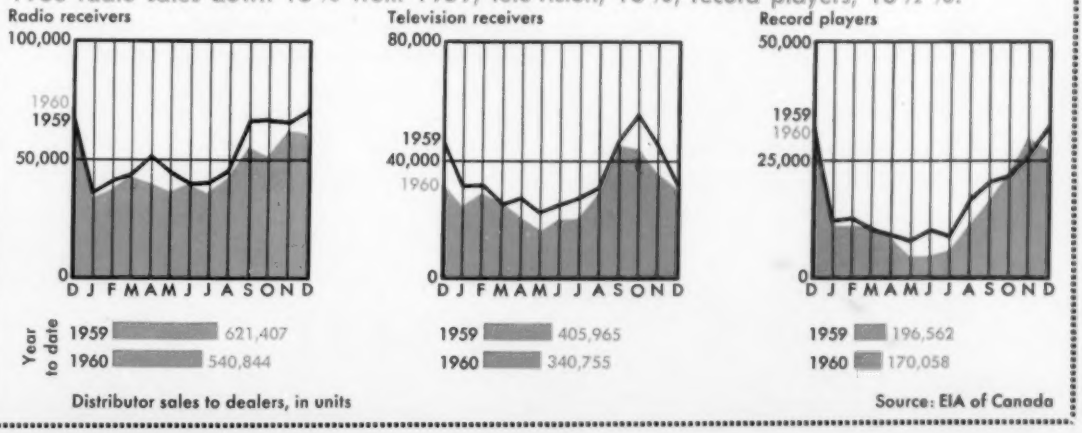
The Department of National Defence will spend $1 million less in 1961-62 buying electronic and communications equipment for the armed services. Items in the estimates covering these purchases show a drop from $45 million in the present fiscal year to $44 million next year. The breakdown by services is: air force, $26.9 million ($28 million in 1960-61); army, $8.7 million ($5 million); and navy $8.5 million ($12 million).

Electronic and communications equipment is not listed separately for other government departments. However, among labelled "acquisition of equipment" in which these items would figure prominently were: Defence Research Board, $3.6 million in the coming year (as against $3.4 million last year); Airports Branch of the Department of Transport, $3.8 million ($3.6 million); Telecommunications Branch of DOT, $1 million ($900,000); Radio Branch of DOT, $212,000 ($335,000); National Research Council, $296,000 ($268,000); and Dominion Observatory, $383,000 ($453,000).

Edmonton's CBXT-TV will be highest power low-band station on continent

RCA Victor is to install the most powerful low-band television transmitter plant in North America at the new CBC station. ERP will be 319 kw almost double that of any low-band station in Canada, and over three time as powerful as any in the United States. This high power output is achieved by a special omni-directional antenna designed by RCA Victor Engineers in Montreal; the 25-kw transmitter will also be built at the Montreal plant.

1960 radio sales down 13% from 1959; television, 16%; record players, 13½%.



Distributor sales to dealers, in units

Source: EIA of Canada

SPAT*

PHILCO ANNOUNCES A COMPLETELY NEW FAMILY OF PNP SILICON TRANSISTORS WITH HIGH VOLTAGE . . . HIGH BETA IN TO-18 PACKAGE

TO-18 CASE

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*Trademark Philco Corp. for Silicon Precision Alloy Transistor

	MAX. RATINGS		CHARACTERISTICS			
TYPE NO.	V_{CBO}	P_{DISS}	I_{CBO} (10v) MAX.	h_{fe} (6v, 1ma) MIN.	h_{fe} (6v, 1ma) MAX.	f_T (6v, 1ma) MIN.
2N858	40v	150 mw	0.1 μa	15	75	5 mc
2N859	40v	150	0.1	30	120	6
2N860	25v	150	0.1	15	45	6.5
2N861	25v	150	0.1	30	100	7.5
2N862	15v	150	0.1	20	60	8
2N863	15v	150	0.1	40	120	10
2N864	6v	150	0.1 (6v)	25	125	16
2N865	10v	150	0.1	100	350	24

Completely new to the industry, these Philco Silicon Precision Alloy Transistors meet a widespread need for medium frequency, high voltage, high beta silicon transistors for both switching and amplifying applications. An exclusive new production technique . . . strip alloying . . . permits accurate measurement of the diode voltage rating and beta of every transistor during the manufacturing process. Never before has such close control in production been possible.

The new SPAT family offers low saturation voltage and high emitter base diode voltage rating. For complete information, write Dept. EDN161.

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TRANSISTOR DISTRIBUTORS—TORONTO—Electro Sonic, 543 Yonge St. • MONTREAL—Canadian Electrical Supply, 275 Craig St. W.

Canadian Westinghouse elects new president, four vice-presidents

John D. Campbell, a past president of the Electronic Industries Association, has been elected president of Canadian Westinghouse Co. Ltd., succeeding **George L. Wilcox** who, after a five-year term as president, becomes vice-president and assistant to the president of Westinghouse Electric Corporation, Pittsburgh.

Mr. Campbell was born in Scotland of Canadian parents and came to Canada in 1919. A 1927 graduate of Trinity College, Port Hope, Ont., he joined Canadian Westinghouse time study department in 1934, and during World War II served overseas as deputy assistant director, ordnance services, 1st Canadian Corps.

Since rejoining Westinghouse in 1946, he has been successively appliance division sales manager 1949; electronics division manager 1951; general manager of both electronics and appliance operations later that year; and general manager of all consumer products activity in 1954.

Elected a vice-president in 1956, he became executive vice-president in 1958, and was elected to the board of directors the following year.

He is a member of the board of governors of McMaster University, Hamilton.

J. E. Cranswick, L. A. McCalpin, D. C. Marrs, and J. W. Henley, have been elected vice-presidents of Canadian Westinghouse Co. Ltd.

Mr. Cranswick, vice-president-wholesale division will direct the marketing of light apparatus products, and Mr. McCalpin has charge of Lamp and Lighting Division plants at Three Rivers and Granby, Quebec, and Electronic Tube Division plants at Hamilton and Grimsby, Ont.

Mr. Marrs will direct the Appliance and Television-Radio operations at Hamilton and Brantford, Ont., and marketing activities through a coast-to-coast distributor and dealer organization, and Mr. Henley is in charge of labor relations, personnel development, salary and wage administration, employment, safety and plant security.

John R. Cann has been elected president of Raytheon-Canada Ltd.

Mr. Cann, a McGill University engineering graduate, joined Raytheon in 1953 as a systems engineer, and in 1955 was appointed manager of the International Division's Toronto office.

He was appointed vice-president and general manager in 1956, and executive vice-president and general manager in 1958.

Mr. Cann succeeds **C. F. Adams,** chairman of the board of the parent Raytheon Company, who remains a member of Raytheon Canada's board of directors.

Campbell

Cann

Cheesman

Deacon

International Telephone and Telegraph Corp. has appointed W. J. Cheesman general manager of Canadian operations.

With headquarters in Montreal, Mr. Cheesman will direct operations of three companies: ITT Electronics Service Co. of Canada Ltd.; Royal Electric Co. (Quebec) Ltd.; Standard Telephones and Cables Mfg. (Canada) Ltd.

Mr. Cheesman, a graduate of the University of Toronto (engineering) served with the Royal Canadian Navy during World War II. Upon discharge he joined Canadian General Electric Co. Ltd. as a laboratory engineer. From 1947 to 1951 he was a research engineer with Ontario Hydro, then joined Canadian Westinghouse Co. Ltd. He served successively as manager of the Electronics Division, assistant general manager of the Apparatus Products Group, and manager of the Light Apparatus Group.

F. W. Deacon has been appointed sales representative for Ontario for Erie Resistor of Canada Ltd.

Formerly with Adams Engineering Ltd., Mr. Deacon has had many years experience in the electronics industry.

He is working out of Erie's Trenton, Ont., plant, but will continue to live in Toronto for the convenience and service of customers. This arrangement is facilitated by Erie's direct Toronto telephone line; the number is EMpire 2-3315.

Leeds and Northrup, Canada, Ltd. promotes J. M. Jackson, J. R. Gowen, and R. C. Park.

Mr. Jackson, former manager of the Philadelphia district office of the parent firm, has been appointed vice-president and general manager of the Canadian company. Previously production manager and assistant secretary, Mr. Gowen is appointed assistant vice-president and assistant general manager. Mr. Park, now assistant treasurer, becomes, in addition, assistant secretary.

Dominion Electrohome Industries Ltd. appoints Donald F. MacRae general manager of the new Appliance, Lighting and Heating Division.

Former director of Industrial Research Services for the Ontario Research Foundation, Mr. McRae joined Electrohome in January, 1960, as manager of the product development department of the Consumer Electronics Division.

John E. Marier has been appointed Vancouver branch manager of Burroughs Adding Machine of Canada.

Mr. Marier held senior sales positions with Burroughs in Toronto and, since January 1958, has been branch manager in Windsor, Ont.

He is succeeded in Windsor by **John P. Bastien,** former sales manager in Toronto.

Boston Insulated Wire and Cable Co. Ltd. appoints Alden C. Davis director, vice-president and general manager, and names R. F. Berner chief engineer.

Davis

Berner

A graduate of Harvard, Mr. Davis has, for the past year, been the firm's manager of Canadian operations.

He was production manager of the company's Boston, Mass., affiliate.

Mr. Berner has been 25 years with the company and 37 years in the electrical wire and cable industry.

(Continued on page 66)

Familiar Bourns Trimpot® potentiometers are now manufactured, stocked and serviced in Canada by and for Canadians. You get the same high quality, the same specifications, the same rigidly tested product as always! You get the same double-check on reliability, too—sample production lots are regularly submitted for complete environmental testing under the Bourns Reliability Assurance Program . . . the only one of its kind in the industry.

Write for the latest brochure showing models and prices . . . or for prompt service, contact our representative, R-O-R Associates Ltd., of Toronto, Ottawa and Montreal.

NOW...MADE IN CANADA, TOO!

BOURNS TRIMPOT® POTENTIOMETERS

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Garrett Mfg awarded $6-million contract for CF-104 data systems

A $6-million contract for the production of central air data computing systems for Royal Canadian Air Force CF-104 jet fighters has been awarded to Garrett Manufacturing Limited.

Delivery is scheduled to begin in the near future and will continue into 1963 for a total of 240 units. The greater majority of the data systems are being built for combat aircraft, while a small portion are intended for trainer and other versions of the high performance Starfighter.

A substantial portion of this work will be subcontracted to other Canadian firms, employing hundreds of Canadians in the aircraft and allied industries. Garrett Manufacturing's activity will be maintained in engineering development, sub and final assembly, testing and inspection functions at the firm's plant in Rexdale, Ont.

After the aircraft becomes operational, Garrett Manufacturing will support the system through its maintenance and overhaul facilities.

The contract is part of an over-all $18-million program in operation by the firm's parent Garrett Corporation of Los Angeles, which developed the central air data system. Units are now in use by, or committed to, Starfighters for the United States, Canada, West Germany, Japan, Belgium and the Netherlands.

The central air data system automatically senses, measures and continuously computes performance requirements relative to such areas as air speed, true mach number, angle of attack, true barometric pressure, altitude and rate of climb. Flight intelligence data is provided to the pilot and to subsystems for autopilot, armament, navigation and induction air control.

Manufacturers appoint representatives

The Moran Instrument Corp., Pasadena, Calif., have appointed **Canadian Research Institute,** Don Mills, Ont. as their exclusive representative in Canada except B. C. (electronic instruments, including digital servo data printers, self-balancing calibrators, precision power supplies).

Willer Engineering & Sales Co., Toronto has been appointed Canadian representative for Transistor Electronics Corp., Minneapolis, Minn. (low-level sensitive indicators, digital readout units, push-button lights and switches, miniature indicator lights, semiconductor test instruments).

Abbey Electronics Ltd., Downsview, Ont. is now the Canadian representative for Thermal Controls, Inc., North Arlington, N.J. (thermal time delay relay switches).

New division for General Dynamics

General Dynamics Corp. has announced the creation of a new division within the corporation, General Dynamics/Electronics. The new division will absorb the former Stromberg-Carlson Division plus those electronic products of other divisions which are, or can be, marketed as separate entities. Hackbusch Electronics Ltd., Toronto, will continue to market these products in Canada.

DOT to instal weather surveillance radars

The Department of Transport is ordering five weather surveillance radar units to be installed at Halifax in 1962 and at Winnipeg, Edmonton and Toronto in 1963. The fifth radar is to be used for research under the precipitation physics project, a study of the cause and effect of precipitation conducted in conjunction with various government and private agencies.

Meanwhile, the department is converting smaller radar sets to be used at London, Ottawa and Quebec as gap fillers between the larger units.

A weather radar in Montreal, now used jointly by DOT's meteorological branch and McGill University, is to stay where it is, while a lower powered radar now at Toronto will be relocated at Regina.

The new radar network will make it possible to issue accurate short range weather forecasts in Canada's metropolitan areas.

Atlas Radio holds sales seminar

The complete sales staff of Atlas Radio Corp. Ltd. gathered in Toronto recently for the company's fourth annual Sales Seminar. During the seminar week, the staff were told of the new products and programs that will be available in 1961, and of steps being taken to improve customer service.

(Continued on page 67)

Ottawa report

Two "relatively small" transshipments of electronic tubes from Japan through the United States to Canada took place after Japan imposed an embargo on further shipments last fall, Revenue Minister George Nowlan told the Commons.

Replying to John Smith (PC-Lincoln), he said substantial quantities were transshipped through San Francisco before Japan imposed the embargo. In mid-November and early December, two further lots of "relatively small quantity" came into Canada by the same route.

Mr. Nowlan said the receiving tubes were placed in a bonded warehouse in Vancouver and when removed were valued for duty at the effective selling price of tubes in the United States.

Subsequently officials of his department refused to disclose the amount of these shipments. "If we did it would reveal to the trade which Canadian company made a deal with the Japanese manufacturers to break the embargo," an official said in explanation.

Since the embargo of last fall, there have been no direct shipments to this country except those already on their way when it was announced. Negotiations to set import quota levels for 1961 are proceeding with no sign at this moment of early success.

The full 100% depreciation rate allowed on small tools has been extended from those costing less than $50 to those costing less than $100. This change in the Income Tax Act announced in the Canada Gazette will allow firms to make a complete one-year write-off for tax purposes of all small tools or pieces of equipment. Above the new $100 limit the tools qualify for varying rates of depreciation, normally 20%.

A slower rate of growth of job opportunities for engineers and scientists over the next three years compared with the last half decade is forecast by the Labor Department.

The department's advisory committee on professional manpower

(Continued on page 68)

THE NEWEST MEMBER OF A FAMOUS FAMILY...

MODEL 9

MODEL 19

MODEL 358-3L

MODEL 260

OTHER CANADIAN MADE MODELS

10	20	77	119	240	270	355	362	370
372	373	375	376	377	378	387	397	590

PP CLASS INSTRUMENTS . . .
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Designed, tooled and manufactured in Canada, these long-scale precision instruments further broaden the choice which Bach-Simpson Ltd. offers the Canadian instrument user. They feature

- 6" mirror scale, designed for maximum readability
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- Self-shielded D.C. movements*, magnetically-damped moving-iron movements for A.C.
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- Quality styling in matte finish phenolic, with finely crafted wood carrying case

The Model PP-1 (D.C.) and PP-2 (A.C.) provide the answer to your most exacting requirement, whether for Laboratory, Classroom or Quality Control. Write for Catalogue C16a and prices.

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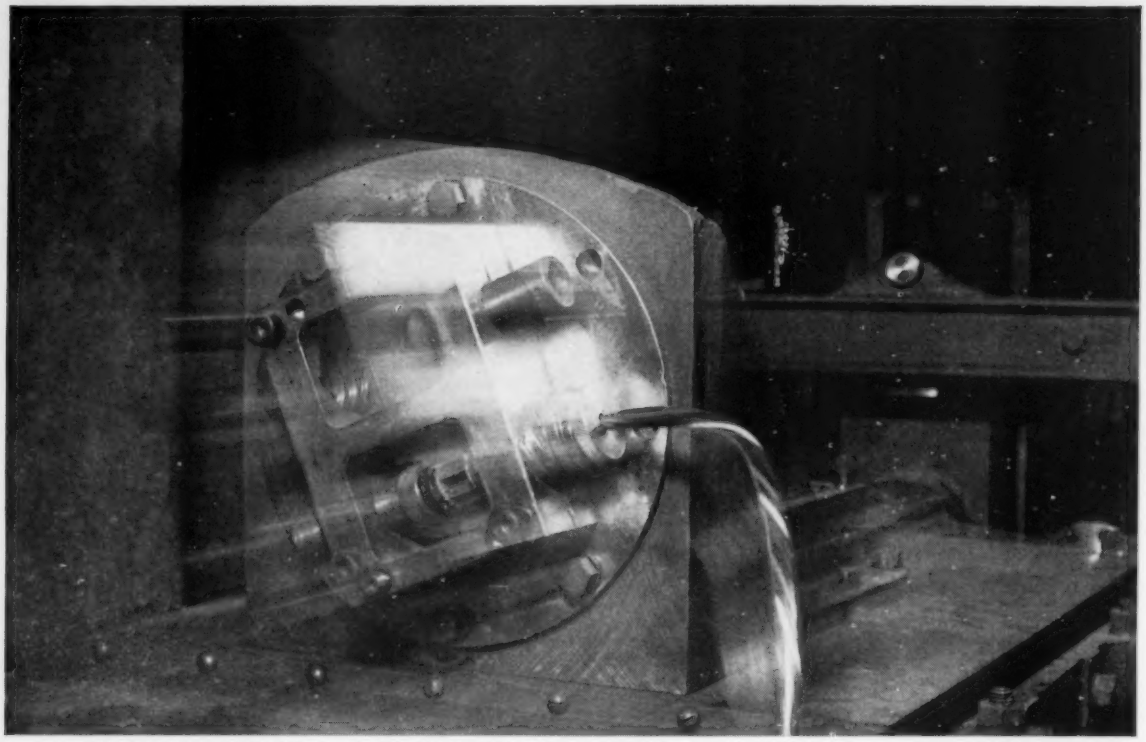
IMPACT!



HOW G-E 5-STAR TUBES ARE SHOCK TESTED. This High Impact Shock Machine subjects daily samples of 5-Star production to five impact accelerations up to 450 G. The tubes undergo this severe test in each of four positions.

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General Electric 5-Star tubes have shorter, sturdier cages . . . double mica spacers . . . welded heater bars and base leads . . . double-staked getters.

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Give your equipment the extra protection of Canadian-made G-E 5-Star tubes. For full information contact: Electronic Tube Section, Canadian General Electric Co. Ltd., 189 Dufferin Street, Toronto, Ont.

GENERAL ELECTRIC
INDUSTRIAL AND MILITARY TUBES

ELECTRONIC TUBE SECTION

TAD-1969-161

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

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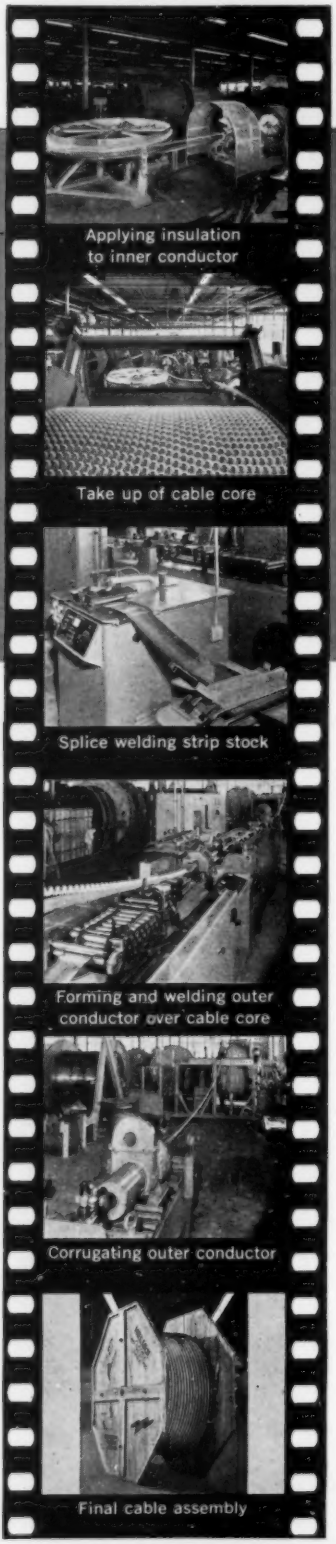
meets every communication requirement

Production scenes



Applying insulation to inner conductor

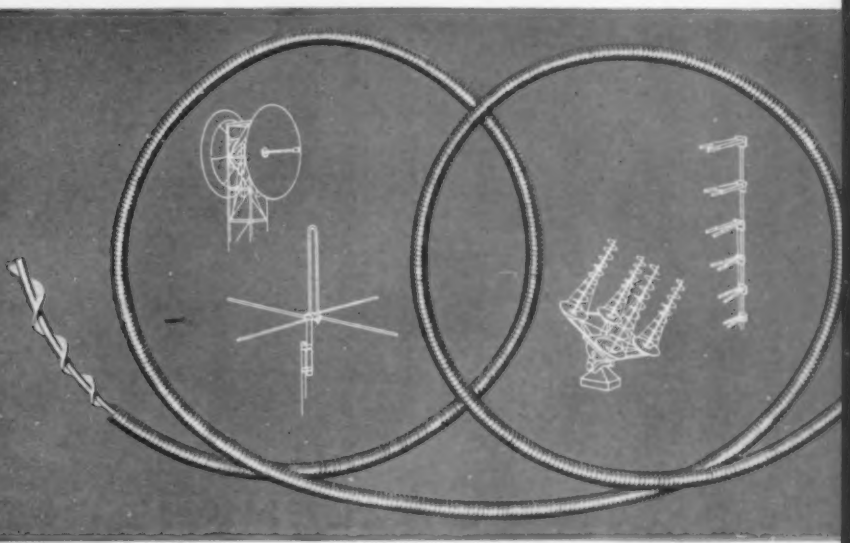
Take up of cable core

Splice welding strip stock

Forming and welding outer conductor over cable core

Corrugating outer conductor

Final cable assembly



Easiest to install...longest to endure

Produced in the new ANDREW plant facilities, HELIAX is the flexible, low loss, low VSWR coaxial cable for use in all applications from VLF through microwave.

The production cycle in which the copper sheet stock is formed around the cable core, welded and corrugated on a continuous basis is depicted in the film strip. Rolled sheet stock provides considerably closer tolerance tubing than is possible by extrusion or other methods.

HELIAX is the *only flexible* air dielectric cable. This flexibility is imparted by the unique, continuous helical corrugated construction. Bending torque required is about one-half that required for straight wall aluminum or copper tubing of the same size.

HELIAX has the greatest resistance to crushing or kinking. Again this is due to its unique construction. Resistance to physical damage from crushing or kinking forces is about twice that of conventional aluminum or copper cables of comparable size.

HELIAX is the only air dielectric coaxia cable capable of being manufactured i continuous lengths. Critical application need no longer depend on splicing 1,00 feet or shorter lengths to make up a lon cable run. HELIAX affords the onl splice free, trouble free air dielectri cable installation.

STANDARD SIZES AND TYPE NUMBERS

SIZE	IMPEDANCE	TYPE NO.
⅜	50	H3-50
⅞	50	H5-50
⅞	75	H5-75
⅞	100	HT5-100
1⅝	50	H7-50
1⅝	75	H7-75
1⅝	100	H7-100
3⅛	50	H2-50
3⅛	75	H2-75

ANDREW is your *only* fully integrated source capable of the design and manufac ture of cable *and* fittings as well a antennas. ANDREW offers a wealth o engineering experience in the field of RF transmission devices.

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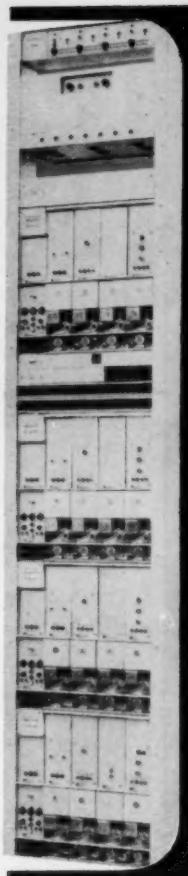

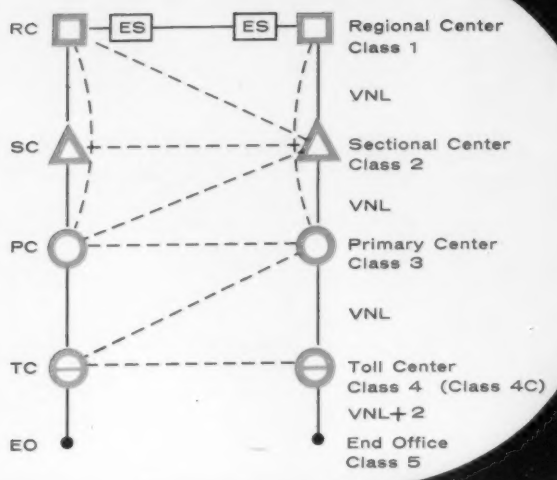

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HIGH PERFORMANCE LOW MAINTENANCE

With the variety of routes made possible by present day toll switching equipment, it is necessary to maintain a consistent net loss over each of the many alternate routes available. This "meeting via net loss" involves, among other things, the reduction of regulation error in the carrier equipment to the absolute minimum.

In a properly engineered system Lenkurt 45C open-wire carrier will automatically maintain channel drop levels to within ± 1.0 db over a wide range of line conditions. The achievement and maintenance of this close tolerance demands the use of pilot regulators, not only on the system but on each individual channel. The slightly higher cost of this approach will pay substantial long term dividends in improved performance and greatly reduced maintenance costs.

In addition to superior regulation, the highly flexible 45C systems provide such features as transistorized repeaters to permit operation from a 48-volt source and interchangeable terminal and repeater common equipment.

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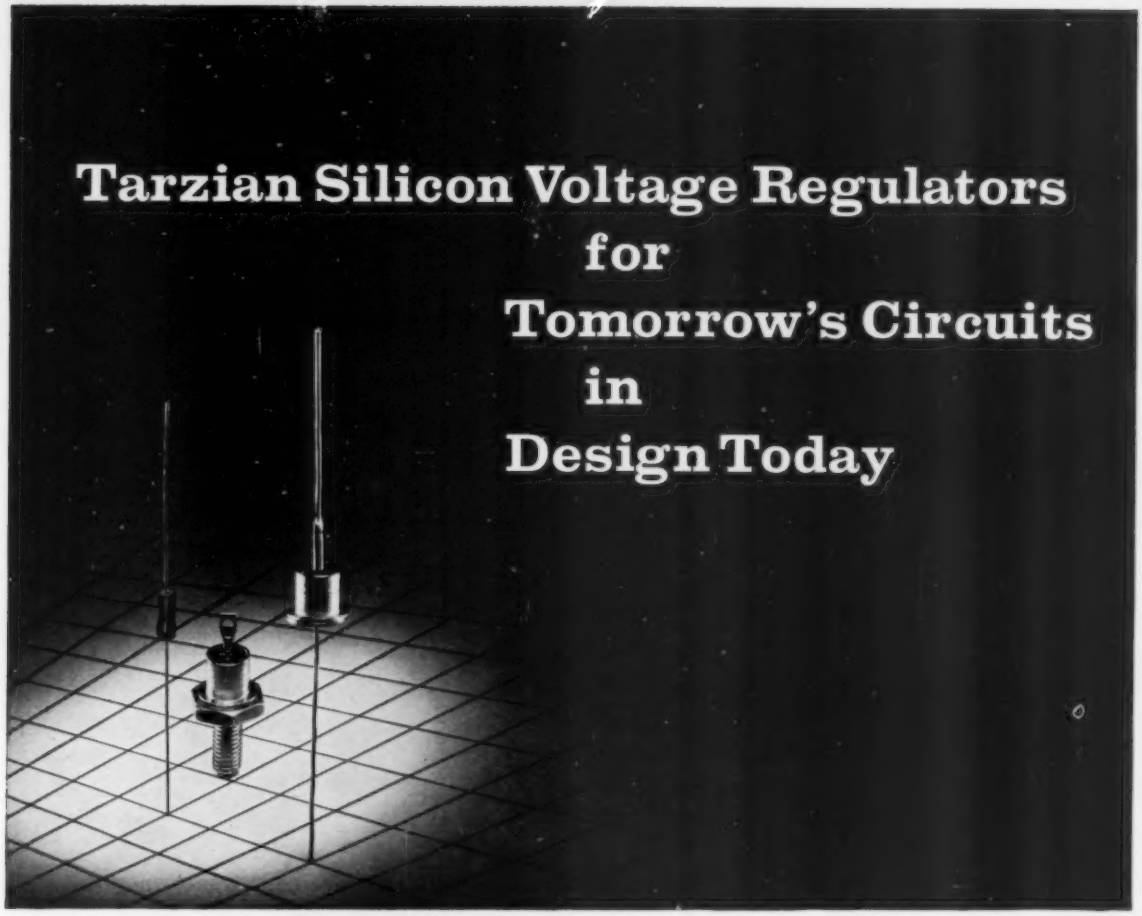
Tarzian Silicon Voltage Regulators for Tomorrow's Circuits in Design Today



TARZIAN SILICON VOLTAGE REGULATORS—in ¼-watt, 1-watt and 10-watt classifications—will serve you well as DC power regulators, AC clippers and limiters, and as protective devices in a wide variety of component protection circuits.

Their small size, inherent ruggedness, and physical simplicity are distinct improvements over other types of regulators. Sharp and instantaneous breakdown (avalanche) characteristics and instantaneous recovery are invitations to inventiveness in circuit design.

Tarzian silicon regulators, like Tarzian silicon rectifiers, are made with a unique blend of care and ingenuity that delivers excellent quality at a realistic price. They are available now from factory or warehouse stocks in sample or volume production quantities. Application engineering service is offered without obligation.

¼ Watt Voltage Regulators
Specifications 25°C.

Tarzian Type	Zener Volt. (V)	Test Cur. (Ma)	Dyn. Imp. (Ohms)	Jedec Type
.25T5.6	5.6	25	3.6	1N708
.25T6.2	6.2	25	4.1	1N709
.25T6.8	6.8	25	4.7	1N710
.25T7.5	7.5	25	5.3	1N711
.25T8.2	8.2	25	6.0	1N712
.25T9.1	9.1	12	7.0	1N713
.25T10	10	12	8.0	1N714
.25T11	11	12	9.0	1N715
.25T12	12	12	10	1N716
.25T13	13	12	11	1N717
.25T15	15	12	13	1N718
.25T16	16	12	15	1N719
.25T18	18	12	17	1N720
.25T20	20	6	20	1N721
.25T22	22	6	24	1N722
.25T24	24	6	28	1N723
.25T27	27	6	35	1N724
.25T30	30	6	42	1N725
.25T33	33	6	50	1N726
.25T36	36	6	60	1N727
.25T39	39	6	70	1N728
.25T43	43	6	86	1N729
.25T47	47	6	98	1N730
.25T51	51	6	115	1N731
.25T56	56	6	140	1N732
.25T62	62	2	170	1N733
.25T68	68	2	200	1N734
.25T75	75	2	240	1N735
.25T82	82	2	300	1N736
.25T91	91	1	340	1N737
.25T100	100	1	400	1N738

1 Watt Voltage Regulators
Specifications 25°C.

Tarzian Type	Zener Volt. (V)	Test Cur. (Ma)	Dyn. Imp. (Ohms)
1T5.6	5.6	100	1.2
1T6.2	6.2	100	1.5
1T6.8	6.8	100	1.7
1T7.5	7.5	100	2.1
1T8.2	8.2	100	2.4
1T9.1	9.1	50	3.0
1T10	10	50	3.5
1T11	11	50	4.2
1T12	12	50	5.0
1T13	13	50	5.8
1T15	15	50	7.6
1T16	16	50	8.6
1T18	18	50	11
1T20	20	15	13
1T22	22	15	16
1T24	24	15	18
1T27	27	15	23
1T30	30	15	28
1T33	33	15	33
1T36	36	15	38
1T39	39	15	45
1T43	43	15	54
1T47	47	15	68
1T51	51	15	74
1T56	56	15	88
1T62	62	5	105
1T68	68	5	125
1T75	75	5	150
1T82	82	5	175
1T91	91	5	220
1T100	100	5	260

10 Watt Voltage Regulators
Specifications 25°C.

Tarzian Type	Zener Volt. (V)	Test Cur. (Ma)	Dyn. Imp. (Ohms)	Jedec Type
10T5.6	5.6	1000	1	1N1060
10T6.2	6.2	1000	1	1N1061
10T6.8	6.8	1000	1	1N1062
10T7.5	7.5	1000	1	1N1063
10T8.2	8.2	1000	1	1N1064
10T9.1	9.1	500	1	1N1065
10T10	10	500	2	1N1351
10T11	11	500	2	1N1352
10T12	12	500	2	1N1353
10T13	13	500	2	1N1354
10T15	15	500	2	1N1355
10T16	16	500	3	1N1356
10T18	18	500	3	1N1357
10T20	20	250	3	1N1358
10T22	22	250	3	1N1359
10T24	24	250	3	1N1360
10T27	27	250	3	1N1361
10T30	30	250	4	1N1362
10T33	33	250	4	1N1363
10T36	36	250	5	1N1364
10T39	39	250	5	1N1365
10T43	43	250	6	1N1366
10T47	47	250	7	1N1367
10T51	51	250	8	1N1368
10T56	56	250	9	1N1369
10T62	62	50	12	1N1370
10T68	68	50	14	1N1371
10T75	75	50	20	1N1372
10T82	82	50	22	1N1373
10T91	91	50	35	1N1374
10T100	100	50	45	1N1375

NOTES: Standard tolerance is ± 10% however, closer or wider tolerances are available on request.
Also available on request:
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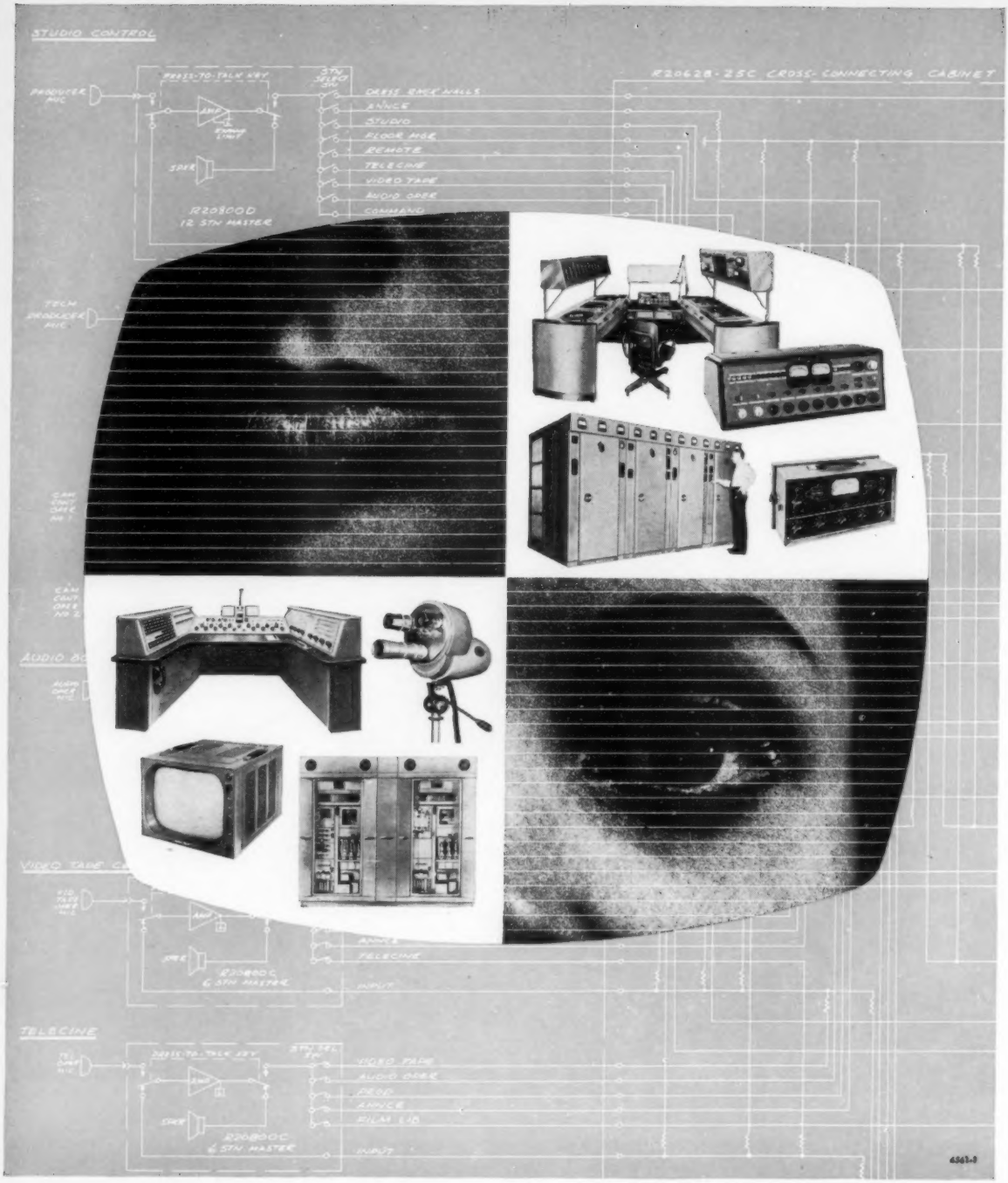

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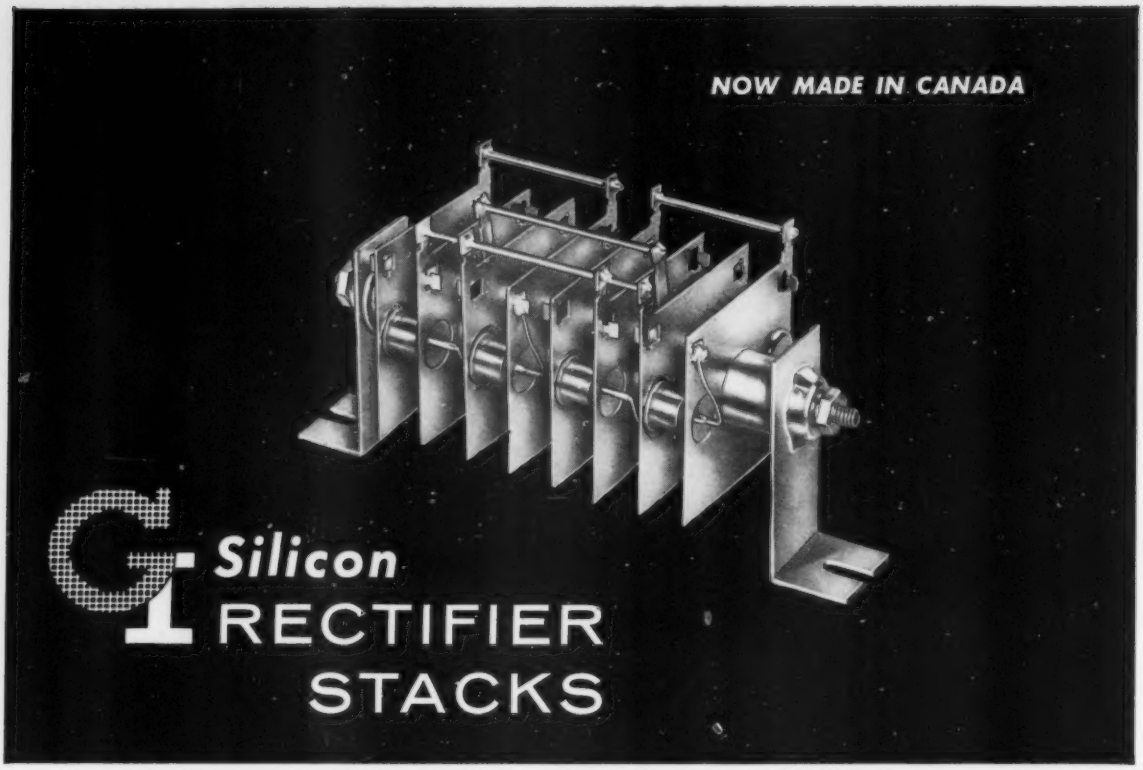

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Three phase — Bridge	From 35	46
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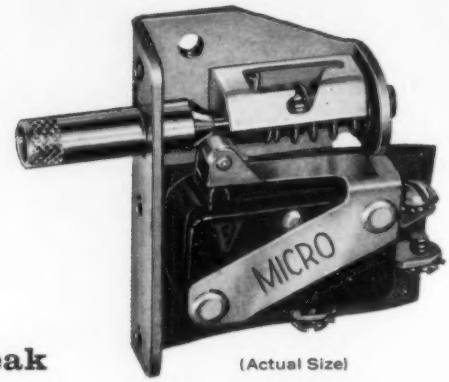
NEW

DOOR INTERLOCK SWITCH eliminates momentary circuit break during re-set



(Actual Size)

13AC Series

17AC Series

22AC Series

8AC Series

24AC Series

A few of the many different door interlock switches available. Write for Data Sheet 186 to your nearby Honeywell branch or write Honeywell Controls Limited, *Precision Components Division*, Toronto 17.

A new model in MICRO's line of protective door interlock switches, the "13AC" is designed to eliminate that momentary power interruption when the interlock is re-set upon closing the door. This feature is particularly desirable on electronic equipment such as data processing consoles, transmitters or computers.

Door interlock switch assemblies automatically break the power circuit when a door or drawer is opened, make it easy to intentionally energize the circuit for check or test, and eliminate the use of dangerous jumpers or tie-downs. When the door is closed, these devices automatically re-set so that next time the door is opened, power is safely cut off.

MICRO SWITCH door interlocks are the ultimate in reliability as protective devices on cabinets and enclosures containing electronic equipment that may be hazardous to personnel. More than 150 models include environment-proof and high temperature designs, subminiature and multi-circuit assemblies and some with self-lubricating thermoplastic actuating rods.

H HONEYWELL **Honeywell**

MICRO SWITCH Precision Switches

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Marconi's

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PLUS FAST

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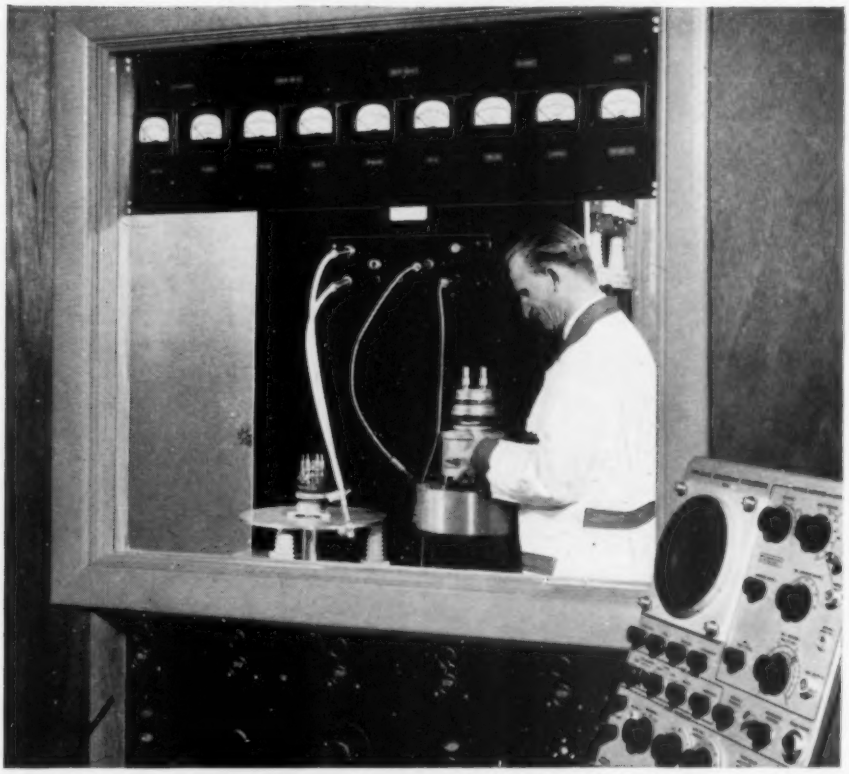
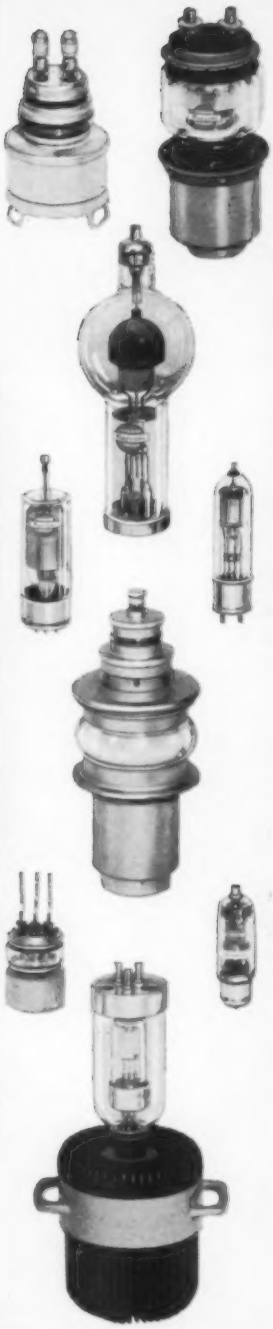


Special Purpose Tubes are tested under simulated operating conditions at the new Marconi Test Lab in Toronto—only lab of its kind in Canada. Here a technician connects a BR1102 Tube in a special pressure-controlled test room.

This means new convenience in Special Purpose Tube service for you. If you are in one of the many industries now using Special Purpose Tubes in complicated equipment you know how important this can be . . . how your whole operation can be held up while you wait for replacement or adjustment of a faulty tube. This is because these tubes are *normally* imported by a distributor and shipped to the customer *without* testing. *Not so a Marconi Special Purpose Tube.* Every one is pre-tested in the new, fully-equipped Marconi Test Lab . . . sealed and protected by the Marconi warranty. If any trouble does occur, you can be sure of *immediate* warranty adjustment. Marconi electronics specialists will give you on-the-spot assistance. This service is as close as your phone.



Canadian Marconi has the widest and most complete range of Special Purpose Tubes in Canada. Marconi's extensive background of experience in electronic tubes and equipment can prove invaluable to you in the selection and use of proper tubes and components for your requirements.

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CREATIVE ENGINEERING *from Bristol!*

Long recognized as a leader in their field, Manitoba Telephone System chose Bristol to design, manufacture and erect one of Western Canada's most unusual structures in the field of microwave communications.

Standing like a sentinel 350 feet above the prairie plains about 30 miles Southwest of Winnipeg, is the latest addition in tower structures forming the central link for future long distance phone traffic between Winnipeg and Portage la Prairie.

This guyed tower, providing a platform to support four 2000 lb. cornucopia reflectors and two 10 foot diameter parabolic reflectors is designed to provide maximum stability against deflection, bending, or twisting under the most adverse conditions of wind, ice loading and low temperature.

Whatever the project – Bristol's Creative Engineering is at your service with a fully qualified engineering staff and outstanding technical support facilities.

You are invited to address your inquiries for product information or engineering assistance to:

BRISTOL AERO-INDUSTRIES LIMITED

WINNIPEG INDUSTRIAL DIVISION • MONTREAL TORONTO WINNIPEG VANCOUVER

A SUBSIDIARY OF THE BRISTOL AEROPLANE COMPANY OF CANADA LIMITED

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ELECTRONICS

. . . Plotting Today the Road to the Future

CANADIAN AVIATION ELECTRONICS LTD. is a rapidly expanding, international Company, owned and controlled by Canadians, engaged in the development and manufacture of electronic equipment for industry and defense. CAE now serves the governments of Canada, the United States, West Germany, Holland and Belgium.

The Eastern Division of the Company, situated in Montreal, is primarily occupied with the Design, Production, Installation and Maintenance of FLIGHT SIMULATOR SYSTEMS and COMPONENTS: Maintenance of FIRE CONTROL SYSTEMS: Repair and Overhaul of ELECTRONIC EQUIPMENT: Operation of MOBILE TEST EQUIPMENT LABORATORIES: Design of INDUSTRIAL INSTRUMENTATION SYSTEMS: Provision of RESEARCH and DEVELOPMENT services and Manufacture of ELECTRONIC EQUIPMENT.

The Western Division, with headquarters at Winnipeg, is responsible for the Operational Maintenance of the Western Section of the MID-CANADA LINE: Depot and Field Maintenance of the PINETREE LINE: Provision of RESIDENT FIELD ENGINEERS AND TECHNICIANS: Repair and Overhaul of ELECTRONIC EQUIPMENT and the Operation of MOBILE RADAR and TEST EQUIPMENT LABORATORIES.

cae

CANADIAN AVIATION ELECTRONICS LTD. has recently created two subsidiary companies in the United States and one in Germany: ONEIDA ELECTRONICS, INC., Utica, N.Y.; CALMONT INDUSTRIES INC., Los Angeles, California, and C.A.E. ELECTRONICS G.m.b.H., Bad Godesberg, Germany.

CAE is entirely owned and operated by Canadians and offers opportunities for career minded young men to develop in a challenging field with a progressive organization. Applications from electronic engineers, scientists and methods men are invited.

Today, CAE provides jobs for more than 1,200 Canadians in the electronics industries and present commitments alone ensure several hundred additional Canadian jobs within the next 12 months.

CANADIAN AVIATION ELECTRONICS LTD.

MONTREAL • WINNIPEG • UTICA, N.Y. • LOS ANGELES, CALIF.

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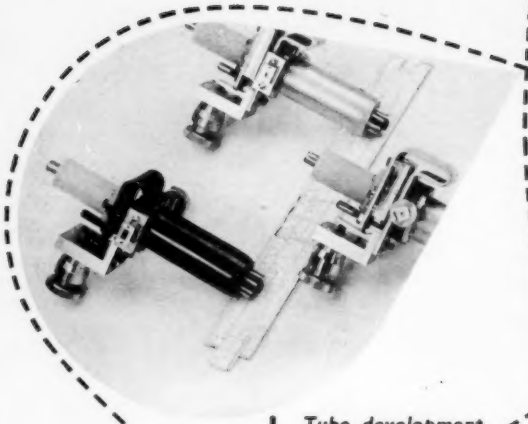
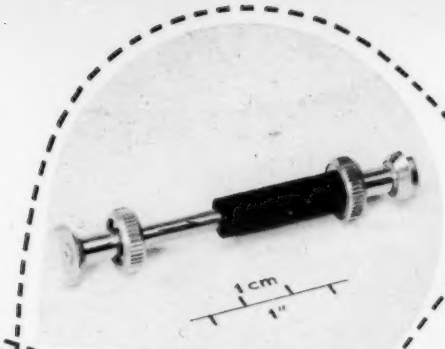
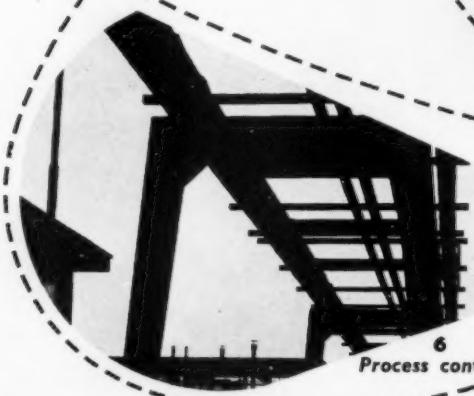


1 *Tube development*



2 *Solid state physics*

3 cm 8 mm
4 mm 2 mm
microwave equipment



6
Process control

PHILIPS *electronic measuring*

Detailed information on microwave components will be gladly supplied on request.

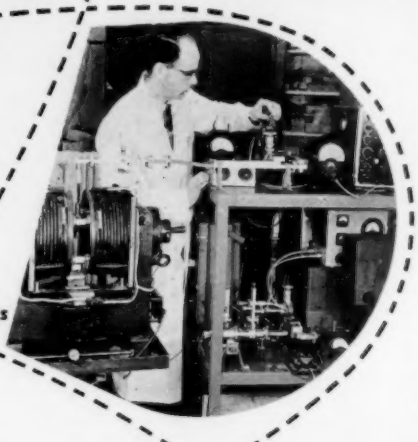
Philips Electronics Industries Ltd.,
116 Vanderhoof Ave., Toronto 17, Ont. · Montreal: 8525 Decarie Blvd.

3 *Telecommunication*

SIX SOUND REASONS WHY

PHILIPS

are good at microwave equipment



4 *Physics*

The world-wide Philips industries are active in many branches of science and technology. Many of these are contributing to the development and application know-how of microwave equipment. The availability of information within the concern - as well as from outside sources - is logically leading to growing ranges of excellent components in the 3 cm, 8 mm, 4 mm and 2 mm bands.

1 *Philips means electronics; klystrons and magnetrons are standard products . . . .*

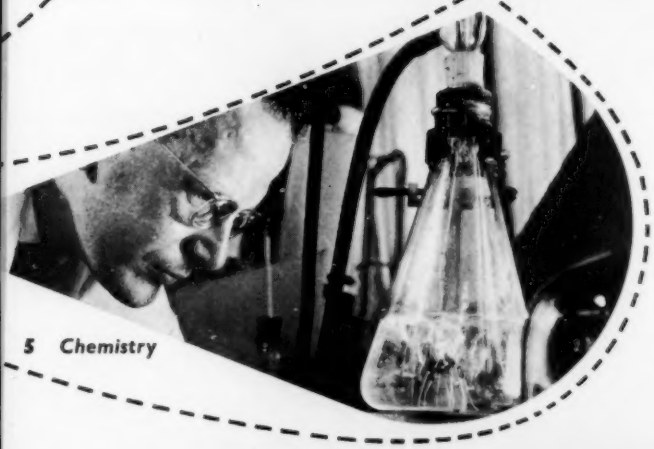
2 *Philips ferrites - well-known and hardly equalled - help to perfect microwave isolators . . . .*

3 *Philips develop and manufacture radar and radio links, a closely allied technology . . . .*

4 *Many applications are in the field of physical research. Philips Research Laboratories are amply equipped . . . .*

5 *Application experience is also supplied by the many chemical specialists within the Philips organization . . . .*

6 *Many impulses come from non-electronic quarters within, as well as outside the concern.*



5 *Chemistry*

instruments: quality ***tools*** for industry and research

PHILIPS

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Select here the VOLTMETERS, AMMETERS, Many are

AC

403A Transistor ac Voltmeter—1 cps to 1 MC

Battery-operated, weighing less than 5 pounds and small enough to hold in your hand — this new transistor ac voltmeter measures 100 μv to 300 v (max. full scale sensitivity 1 mv) over frequencies 1 cps to 1 MC! Twelve voltage ranges; also reads direct in db from —72 to +52 db. 400 hour battery life equals 6 months of average use; battery voltage may be checked by front panel switch. Noise less than 30 μv on all but lowest range. Completely isolated from power line or ground interference. Average reading meter minimizes turnover and waveform errors. Accuracy ±3% to 500 KC, ±5% to 1 MC. Input impedance 2 megohms; generous 600 v overload capacity on higher ranges, 25 v maximum on lower ranges. $275.00.

All of these widely useful -hp- instruments are available in rack-mounted -hp- voltmeter accessories—voltage dividers, coaxial connectors, voltage

DC

405 Digital Voltmeter
Automatic range, polarity

Here's true "touch-and-read" measuring simplicity. Automatic range, polarity selection; covers 0.001 v to 1,000 v. (Accuracy ± 0.2% of reading ± 1 count). New, unique circuitry provides a stability of readings virtually eliminating fatiguing jitter in the last digit. Floating input, multi-electronic code output for use with digital recorders. Uses electronic computing circuits to insure low maintenance, trouble-free operation. Just 7" high! $850.00, $925.00.

Complete array of ac and dc measuring equipment

versatile, precision OHMMETERS you need. multi-purpose!

hp 400D
10 cps to 4 MC

Regarded by many as finest ac VTVM ever built. Covers all frequencies 10 cps to 4 MC, extremely sensitive, wide range, accurate within 2% to 1 MC. Measures 0.1 mv to 300 v (max. full scale sensitivity 1 mv), 12 ranges. Direct reading in v, db. 10 megohm input impedance with 15 $\mu\mu$f shunt insures negligible loading to circuits under test. $250.00.

hp 400L
Log VTVM—10 cps to 4 MC

Covering 10 cps to 4 MC, this new hp VTVM features a true logarithmic scale 5" long plus a 12 db linear scale. The log voltage scale plus long scale length provides a voltmeter of maximum readability, with **accuracy a constant percentage of the reading.** Accuracy is ±2% of reading or ±1% of full scale, whichever is more accurate, to 500 KC, ±5% full range. Range 0.3 mv to 300 v, 12 steps, (max. full scale sensitivity 1 mv). $325.00.

hp 400H
1% accuracy VTVM

Here's extreme accuracy of 1% in a precision VTVM covering 10 cps to 4 MC. Big 5" meter has exact-reading mirror-scale, measures voltages 0.1 mv to 300 v (max. full scale sensitivity 1 mv). 10 megohm resistance with 15 $\mu\mu$f shunt minimizes circuit loading. Amplifier with 56 db feedback insures lasting stability. $325.00.

hp 410B
ac to 700 MC, also dc

Time-tested standard all-purpose voltmeter. Covers 20 cps to 700 MC, full scale readings 1 to 300 v. Input capacity 1.5 $\mu\mu$f, input resistance 10 megohms. Also serves as dc VTVM with 122 megohms input impedance, or ohmmeter for measurements 0.2 ohms to 500 megohms. $245.00.

models! Also, inquire about multipliers and shunt resistors.

HEWLETT-PACKARD COMPANY
1004K Page Mill Road • Palo Alto, California, U.S.A.
Cable "HEWPACK" • DAvenport 6-7000
Field representatives in all principal areas

6490

hp 412A Precision Volt-Ohm-Ammeter

At last a true, **precision** multi-purpose instrument. Measures dc voltage 100 μv to 1,000 v (max. full scale sensitivity 1 mv), 1% accuracy full scale. Measure currents 1 μa to 1 amp with ± 2% accuracy full scale. 13 ranges. As ohmmeter measures 0.02 ohms to 5,000 megohms. Extremely low noise, drift. Recorder output provides 1 v full scale. $400.00.

hp 425A Microvolt-Micromicroammeter

New, high sensitivity, high stability instrument reading end scale voltages of 10 μv to 1 v in 11 ranges, or currents of 10 $\mu\mu$a to 3 ma in 18 step, 1-3-10 sequence. Accuracy ±3% on all ranges. Drift less than 4 μv per day. Input impedance 1 megohm ±3% on all ranges. Also usable as 100 db amplifier with up to 1 v output from signals as small as 10 μv. $500.00.

hp 428A/B Clip-On Milliammeter

Employs radical new approach to current measurement which eliminates breaking leads, soldering connections or loading of circuit under test. Revolutionary "current sensing" probe clips around wire under test, measures the magnetic field around the lead. Easily measures dc current in presence of strong ac. Covers 0.3 ma to 1 amp in 6 steps; full scale sensitivity 3 ma. Accuracy ±3%, probe inductance less than 0.5 μh. $500.00, $550.00.

—unique value, traditional -hp- dependability

For further information mark No. 42 on Readers' Service Card

Meeting or Exceeding MIL-R-26C Specifications

(Characteristics "V" and "G")

MARSLAND

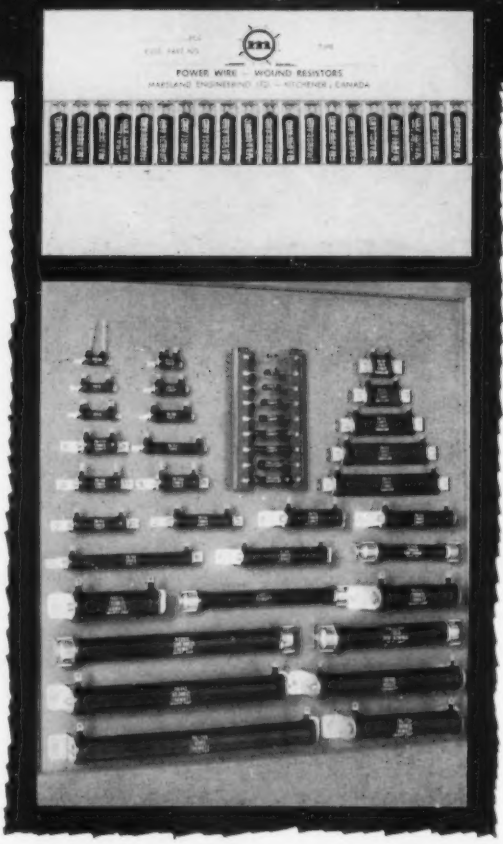
Vitreous Enamelled

RESISTORS

For new production designs or exact replacement in electronic circuit applications

Marsland Power Wire Wound Resistors have C.A.M.E.S.A. and A.S.E.S.A. approval under MIL-R-26C Specifications in the following styles:-

(a) Axial Terminal . . types RW55 to RW59 inclusive
(b) Tab Terminal . . . types RW29 to RW47 inclusive



Marsland Resistors feature special alloy terminals tinned for quick, efficient circuit soldering. The resistance element is wound with alloy wires developed to minimize thermal drift. Terminals are welded or silver brazed. The multi-layer enamel coating, fired at temperatures above 1200°F effects a complete seal against moisture or corrosive fumes. Marsland controls production quality by continuous meticulous testing under environmental conditions.

MARSLAND PRODUCTS: Electro-mechanical Assemblies • Precision Gears • Rotary Solenoids • Hermetically Sealed Relays • Loudspeakers • Tuning Capacitors • Servo Components and Complete Systems • Power Resistors • Special Armed Services Equipment.

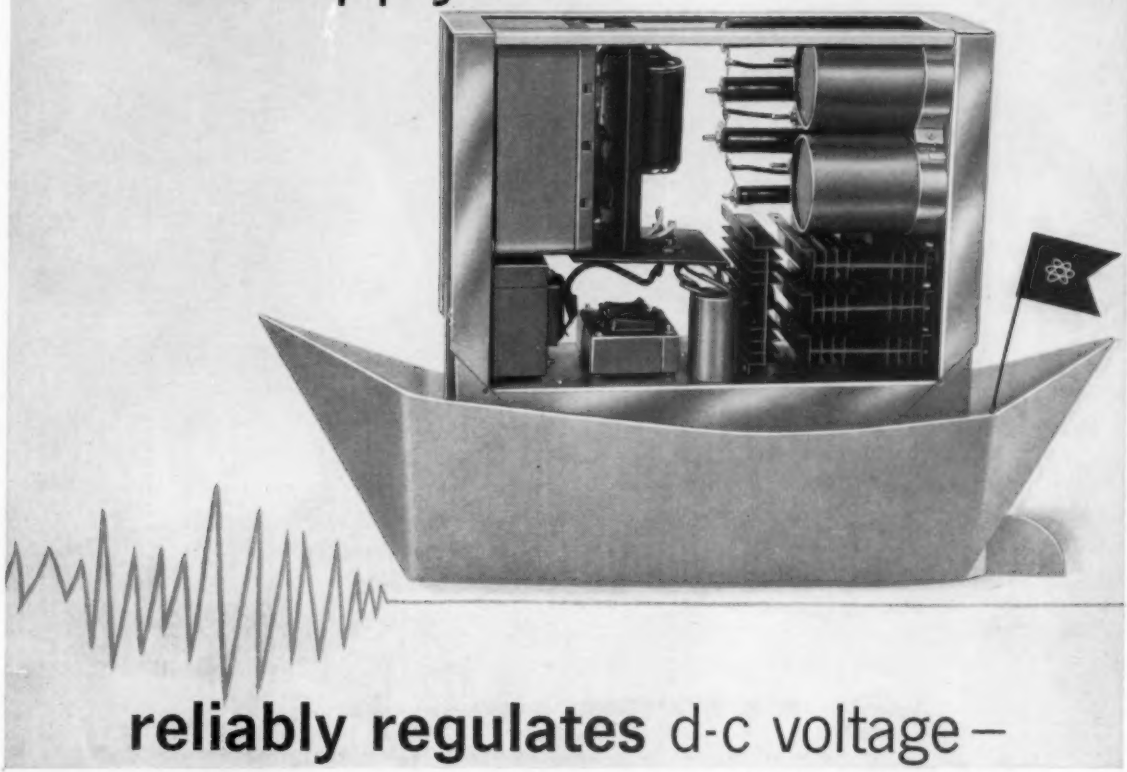
MARSLAND ENGINEERING LIMITED

M/4

KITCHENER, ONTARIO, CANADA

For further information mark No. 51 on Readers' Service Card

new SOLA transistorized d-c supply...



reliably regulates d-c voltage – right down to the last **"ripple"!**

New highly sensitive SOLA "CVQ" provides transistor-regulated d-c output ideal for computers and other *voltage-sensitive equipment*. Response to voltage change is so rapid the CVQ even attenuates 120-cycle ripple! Yet, with it all, this new d-c supply introduces a revolutionary circuit simplicity — providing significant savings in sizes . . . more watts per dollar!

CVQ combines exclusive transistorized shunt regulation with SOLA's inherently self-protecting, static-magnetic transformer . . . easily meets the most taxing demands of dynamic loading. Voltage holds in spite of widely fluctuating loads. The result is longer equipment life, more trouble-free operation. Contact our area representative for complete specifications and prices. Or write today for literature on CVQ.

- Standard models available at 5, 6, 10 and 12 volts d-c (100-130/181-235/200-260 volt input).
- Output regulated within ±0.04% for line voltage variations ±15%; 0.2% static-load regulation, 0 to full load.
- Excellent transient response.
- Inherent protection against output over-voltage safeguards both supply components and external circuitry.
- Short-circuit proof design.
- Compact mechanical layout — only 12¼ x 5¼ x 19"

Write for Bulletin CV

SOLA

An Affiliate of Basic Products Corporation

BPC

SOLA-BASIC PRODUCTS LTD., 377 Evans Ave., Toronto 18, Ont.

For further information mark No. 68 on Readers' Service Card

How versatile **Cronaflex*** streamlines production

Union Switch & Signal Division of Westinghouse Air Brake Company has discovered that CRONAFLEX, made by Du Pont, saves time and expense in several different ways in the design and manufacture of automatic control equipment for railroads and pipelines.

First of all, diagrams of control systems do not have to be completely redrawn if they contain the basic elements. Instead, the basic data is drawn once and then photographically reproduced on CRONAFLEX as many times as necessary, and the variable additions added to meet the specific requirement.

When preparing wiring diagrams for complex systems, Union Switch & Signal starts with reproducible template prints that contain basic parts of a composite control system. On these the designer adds the required wiring information. Then he cuts out the unused elements and reproduces the selectively cut print on CRONAFLEX, which serves as the final tracing.

CRONAFLEX is also used to make accurate, legible reproduced tracings of valuable originals which due to age and use have developed poor contrast causing illegible reproductions.

In addition, CRONAFLEX helps this company put an accurate picture directly on metal or plastic parts, eliminating expensive layout time for machining operations. The material is spray-coated with a photosensitive emulsion, placed in contact with the layout drawing on CRONAFLEX, and exposed in a vacuum frame. After development the piece is engraved, punched or machined for use as part of a product or used as a template in punching operations, directly from the picture on the material. This is feasible because CRONAR* base of CRONAFLEX resists shrinking and stretching caused by changes in temperature and humidity.

Versatile CRONAFLEX can work profitably for you, too. For more information write Du Pont of Canada Limited, Photo Products, 85 Eglinton Ave. East, Toronto 12, Ontario.

Unwanted elements of a drawing are cut from the composite print before reproducing on CRONAFLEX. This saves time spent in laborious eradicating.

CRONAFLEX is also used to make metal or plastic templates. Material is spray-coated with emulsion, then CRONAFLEX drawing is printed right on the surface.

DU PONT CANADA

Better Things for Better Living ... *through Chemistry*

PHOTO PRODUCTS

CRONAR*
CRONAFLEX*
CRONAPAQUE*

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For further information mark No. 53 on Readers' Service Card

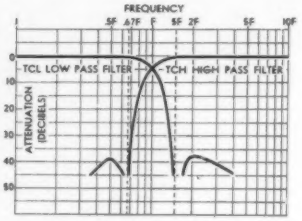
Current Reference
FOR LOW COST FILTERS

Each time circuit design calls for low pass, high pass, interstage or band pass filters in communications, guidance and control, it's the reliable, economical filter that counts. For filters that are right up there in front of you when you need them, order these and other filters from the Burnell & Co. standard catalog.

STANDARD

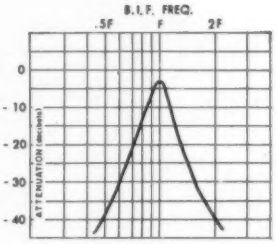
TCL—LOW PASS—TCH HIGH PASS FILTERS

These popular low cost filters find many useful applications. A band pass filter results when cascading a TCL with a TCH filter. Standard impedances are 500/600 ohms and 10K. For 60 cps to 300 cps, case size is 1¾ sq. x 3, 400 cps and up 1-3/16 x 1-11/16 x 2¼ H.



BIF—BAND PASS INTERSTAGE FILTERS

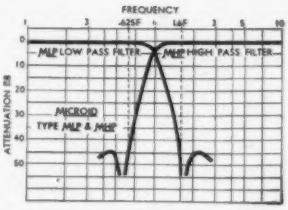
These economical Burnell band pass interstage filters are designed for a wide variety of applications. Input impedance is 10K output to grid with a voltage gain of approximately 2:1. Any frequency between 60 cps and 100 kc is available. 3 DB bandwidth nominally 8%. Size as above.



MICROID®

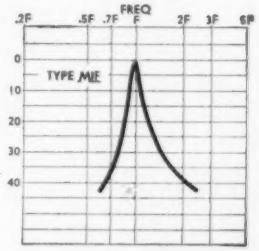
MLP —LOW PASS— MHP HIGH PASS FILTERS

The MLP and the MHP are micro-miniature counterparts of the TCL and TCH low pass and high pass filters. Standard impedance is 10,000K. Case sizes are as follows: 400 cps to 1.9 kcs, 11/16 x 15/16 x ½, 2 kcs to 4.9 kcs, 11/16 x 1⅝ x ½, 5 kcs and up, ⅝ x 15/16 x ½ H. Wt. of both MLP and MHP Microids, approximately .3 ozs. each.



MIF—INTERSTAGE FILTER

Input impedance for the MIF micro-miniature interstage filter is 10,000K to grid with a voltage gain of approximately 2:1. The 3 db band width is nominally 8%. Covering frequencies from 7.5 kcs to 100 kcs these interstage filters are provided in the same case sizes as the MLP



F_o CPS.	TCL 10K	TCL .6K	MLP 10K	TCH 10K	TCH .6K	MHP 10K	BIF 10K	MIF 10K
60~	59079	65950		55853	55579		17550	
100~	61367	63915		62942	55580		17228	
120~	64129	65951		65962	65975		17551	
200~	19971	61740		55759	65977		21391	
400~	65938	55370	71028	64419	29877	71015	17230	71000
500~	50176	29562	71029	55760	26174	71016	17231	71001
750~	50177	20310	75242	55993	75244	75243	17232	71002
1000~	50178	29563	71030	31724	65978	71017	17233	71003
1500~	50179	65953	71031	75245	66283	71018	17234	71004
2000~	50180	65954	71032	65963	62608	71019	17235	71005
3000~	50182	29566	71034	31725	59292	71021	17237	71007
4000~	50183	20312	71035	75246	66278	71022	24720	71008
5000~	50184	22400	71036	36826	23324	71023	17238	71009
10000~	50187	29569	71037	31726	22122	71024	17239	71011
20000~	50771	75247	71038	50774	75248	71025	21169	69613

If your filter needs can't be met from our large stock catalog, we'll be glad to manufacture to your specifications

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Burnell & Co., Inc.

PIONEERS IN microminiaturization OF TOROIDS, FILTERS AND RELATED NETWORKS

For further information mark No. 33 on Readers' Service Card

NEW WESTON SENSITROL COMBINES HIGH ACCURACY, "RUGGEDIZED" CONSTRUCTION

3.5" relay meets MIL specifications for ruggedized, sealed instruments

A new addition to the Weston Sensitrol® family, Model 1097 SENSITROL is a sealed, ruggedized DC meter-type relay with contact-aiding coils. Auxiliary windings increase torque and provide firm contact pressure.

"Ruggedized" construction assures reliable service under extremes of shock, vibration, temperature and humidity. Mechanism features spring-backed jewel design, and is supported on shock mounting plates integrally molded and bonded to case in specially compounded rubber. Steel housing and Cormag® mechanism offer excellent shielding against external magnetic fields.

Zero-corrector and contact adjustments are sealed through face of rugged plastic window. Slotted, knurled contact adjustments may be hand or screw-driver operated. Other features of Model 1097 and smaller (2½") Model 1093 include: 100° arc movement; sealed header with solder terminals for all connections; and single or double contact-aiding coils.

For more information, call or write Daystrom Limited, 1480 Dundas Highway E., Cooksville, Ontario; 5430 Ferrier Street, Montreal 9, Quebec. A subsidiary of Daystrom, Incorporated. Or any office of Northern Electric Co. Ltd.

Daystrom-Weston Instruments are now MADE IN CANADA to Canadian Standards.

Model 1097 Load Current-Contact Aiding Relay is 3½" in diameter, with a 100° scale. Accuracy: within 2% of full scale. Contact rating 5-25 ma DC at 75-125 volts DC. Available in 24 types.

DAYSTROM LIMITED

World Leaders In Measurement and Control

6119

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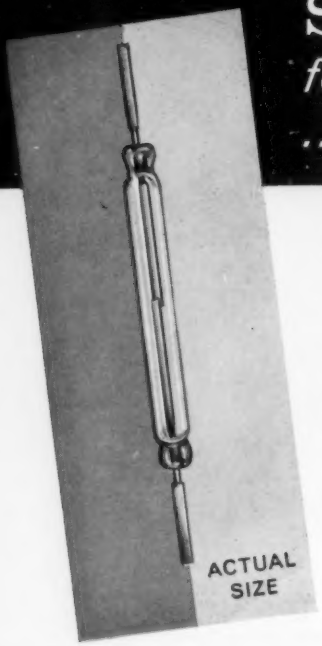
CLAREED®

Sealed Contact Relays...
for contamination-free operation ...positive on-off switching



CLAREED solves the vexing problem of contact contamination. Its sealed, gold-plated contacts operate indefinitely in an in-built ideal environment, give positive on-off switching for up to millions of cycles. It is a relay you can install and forget.

This maintenance-free operation makes CLAREED sealed contact relays ideal components for such critical applications as transistor drives, computers, data processing equipment and many other high-speed devices.

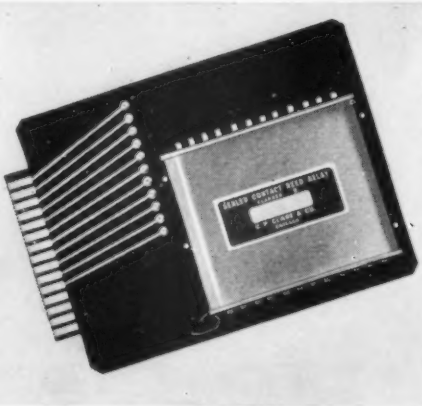
CLAREED design is simplicity itself—a pair of magnetically operated contacts, hermetically sealed in an atmosphere of inert gas within a glass capsule. Compact size permits almost unheard-of flexibility of assembly and application.

See Clareed Relays in working logic modules... No tubes, no transistors.

IRE SHOW BOOTHS 2218 & 2220

Typical space-saving Clareed Relay Assemblies

This cylindrical can contains one, two or three CLAREED switch capsules which form the core of a common coil. Numerous variations of this design are possible to meet customer requirements.



CLAREED relay consists of 12 switch capsules enclosed in a rectangular container and mounted on printed circuit board. Varied coils and contact arrangements available.

Here is a CLAREED relay module for printed circuits. Quick, convenient mounting on your own prototypes or assembly line. High component density. Sturdy steel cover provides magnetic shielding.

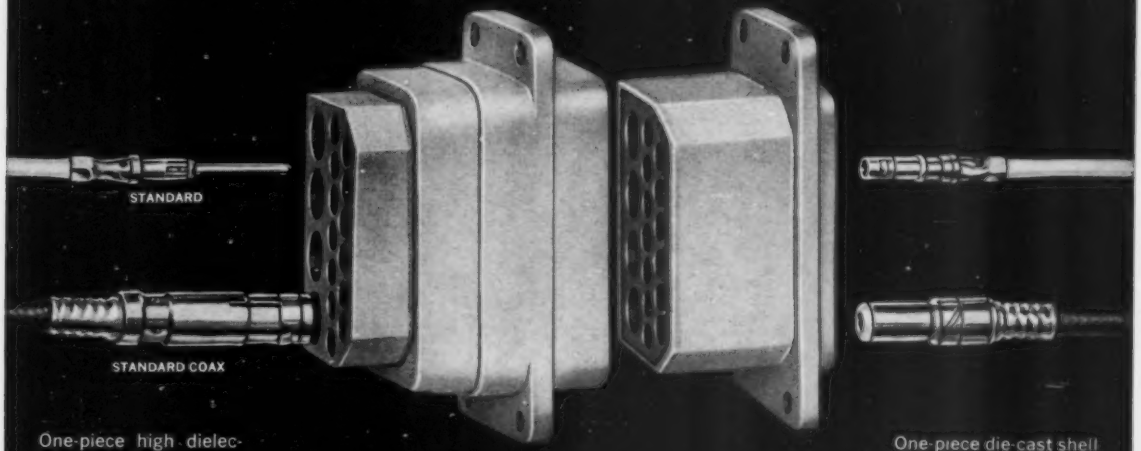
C. P. CLARE & CO.

Relays and Related Control Components

If you use relays, it will pay you to know all about CLAREED relays ...an entirely new concept in relay design. To obtain Bulletin CPC-10, address: C. P. Clare & Co., 3101 Pratt Blvd., Chicago 45, Illinois. In Canada: C. P. Clare Canada Limited, 840 Caledonia Road, Toronto 19, Ontario. Cable Address: CLARELAY.

HYFEN®

RACK and PANEL CONNECTORS



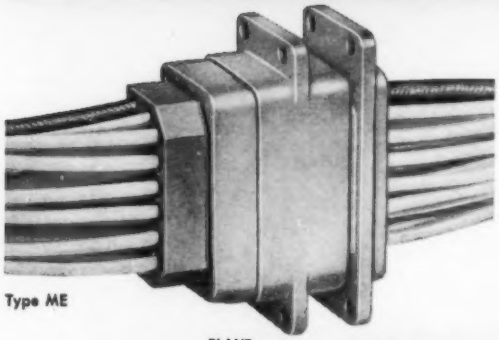
One-piece high dielectric strength insert contains molded-in ferrules for positive contact retention. Eliminates one cause of moisture entrapment.

Configurations accommodate three types of contacts: 1. Standard 2. Standard Coax 3. Miniature Coax (below), in any combination. All are plated in accordance with your requirements and are crimp-type, snap-locked HYFEN contacts.

MINIATURE COAX

One-piece die-cast shell design permits inserts to be interchanged in shells... allowing dead front in either plug or receptacle.

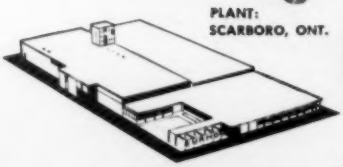
crimped-contact reliability—snap-lock versatility



Type ME

Burndy's line of rack and panel HYFEN connectors offers the high reliability of crimp-type, snap-locked contacts. The versatility of the HYFEN technique is increased by the accommodating of a wide range of wire types and sizes... coax, miniature coax and standard cable.

FOR FURTHER INFORMATION CONTACT OMATON DIVISION



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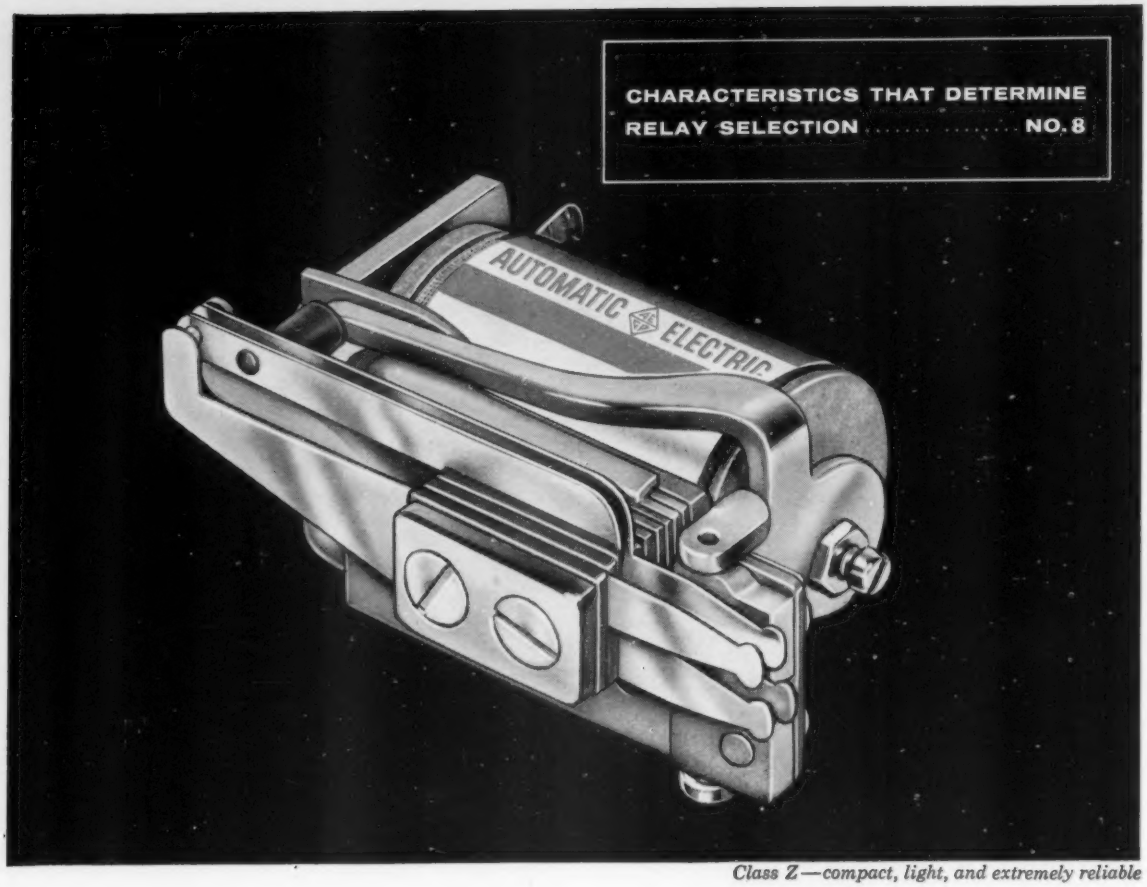
For further information mark No. 21 on Readers' Service Card



Class Z—compact, light, and extremely reliable

where size and weight are important considerations

Helpful selection data
Class Z series

CONTACTS
Normally single, Code No. 4-18 ga.
others available

OPERATING VOLTAGE
ac Max. 115 volts, dc Max. 135 volts,
or 115 volts depending on type

OPERATING TIME
0.002 to 0.050 seconds
depending on type

RELEASE TIME
0.005 to 0.200 seconds
depending on type

Where an application calls for a relay that's small in size and extra light in weight, your best choice is the Class Z series by Automatic Electric.

Class Z relays provide all the basic advantages of famous Class A relays—including the unique contact springs and pin-hinged armatures—in only five-eighths of the space, and with only about half the weight. Springs are located at the armature end of the heelpiece. The heelpiece and coil are both much shorter, and the relays measure only 2½ inches overall.

Class Z relays are available in a broad range of types. Despite their small size, they are surprisingly sensitive. Their time delay characteristics and the number of contact forms available make them readily adaptable to many different requirements, and they have adequate coil volume to permit slugging for long operate and release timing.

For details of standard and custom assemblies, call or write Automatic Electric Sales (Canada) Limited, 185 Bartley Drive, Toronto 16, Ont. Branches across Canada.

AUTOMATIC ELECTRIC
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

AN ORGANIZATION SERVING CANADIAN INDUSTRIES WITH COMMUNICATION AND CONTROL SYSTEMS

6110

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Why not look into export possibilities?

Faced with a relatively small domestic commercial market and diminishing defense orders, more and more Canadian electronics manufacturers will have to turn to commercial exportation and the requirements of integrated defense programs to find an outlet for their products. And they can increase their chances of success by investing in new product development — companies who have done this have proved that Canadian engineers can come up with designs that can hold their own in world markets.

Starting on the next page we present a review of the latest Canadian developments in electronic components, instruments and equipment. Many of the items described have already been sold successfully to military or commercial customers outside Canada. It is significant to note that the majority of these are highly specialized low-volume products, rather than mass-produced items.

Of course, the development of suitable products is not sufficient in itself. An adequate marketing organization is also essential — one which is thoroughly familiar with the techniques of selling abroad and is prepared to arrange proper representation and promotion in the countries whose markets it hopes to penetrate.

These tasks, however, should not be regarded as formidable, since much assistance is available from our Department of Trade and Commerce in Ottawa and the Trade and Industry branches of the provincial governments. The Department has recently demonstrated its eagerness to promote Canadian export trade by convening the Trade Conference of last December. Its personnel are always willing to help by giving valuable advice on all aspects of the subject, arranging Canadian exhibits at foreign trade fairs, and through their various publications.

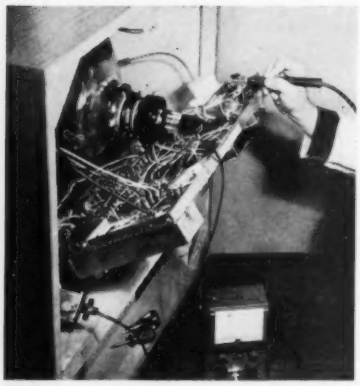
"Foreign Trade," published fortnightly by the Department, is available from the Queen's Printer, Government Printing Bureau, Ottawa at $2 a year in Canada. "The Techniques of Foreign Trade," published in 1957 and also available from the Queen's Printer, contains a series of useful articles reprinted from "Foreign Trade" on subjects such as: the first steps, how to finance and insure exports, preparing goods for shipment, from seller to market, promoting export sales, special export problems, etc.

We at CEE are doing our bit by publishing stories of Canadian achievements and sending copies of this publication regularly to Canada's trade commissioners and commercial counsellors abroad. We wish you every success in your efforts!

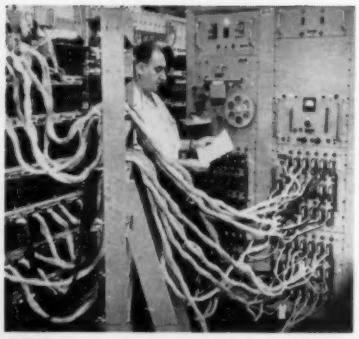
THE EDITOR

New products review

101



102



103

Psychological sound equipment 101

Designed in consultation with the dental and medical professions, Sonalgenic psychological sound equipment offers many features requested by the doctors and dentists. Circumaural stereo headphones provide high fidelity reproduction of the music while eliminating operatory noises. They provide accoustic isolation of over 40 db. The patient holds a small control unit which permits him to select either of two music programs, as well as the volume for music and white sound. Calibrated dials on the main unit permit visual check of volume levels so the dentist can enter the information on the patient's record. The main unit has a small monitor speaker so the dentist can hear the sound level fed to the earphones, and there is a microphone controlled by a foot switch which permits the dentist to speak to the patient (when wearing the headphones it is not possible to hear any conversation).

The main unit contains the white noise generator, but does not produce the music. This can be supplied from a stereophonic tape recorder, radio, or other source. In group practice, several Sonalgenic units can be supplied music from a common source. Maximum levels of music and white sound are limited below the accepted accoustic threshold of pain. For the white sound it is 124 db.; for the music it is 124 db. for 50 mv. input on the high range, and 112 db. for 50 mv. input on the low range.

Philips Electronics Industries Ltd., Toronto.

TV/radio/phono combinations 102

New 23-in. Admiral table, console and lowboy models of TV receivers feature a swing-out chassis for easy servicing. Removal of three easily accessible screws permits the serviceman to swing the chassis out and replace practically every component without removing the chassis from the cabinet. The 1961 line of Admiral combinations includes 19- and 23-in. TV, AM and FM radio, and record players with up to 4-speed changers. Stereo models are included. The component content of all these products is more than 90% Canadian; labour is 100%.

Canadian Admiral Corp., Ltd., Port Credit, Ont.

Automatic circuit and cable tester 103

This tape-controlled universal automatic tester for electronic assemblies and cables has a capacity of 600 test points and may be extended to 2400 points. It will test continuity over the range of 0.1 to 10 ohms; resistance over the range of 1 ohm to 10 megohms; leakage over the range of 10-700 megohms; dc voltage from 1.0 to 800 volts; ac voltage from 2.5 to 800 volts (average measuring, calibrated for sinusoidal rms or average); ac impedance (60 cps value) from 10 ohms to 1 megohm. The equipment incorporates many operating features and auxiliary equipment is available.

Sperry Gyroscope Co. of Canada Ltd., Montreal.

Fast acting dc-ac inverter 104

These dc-ac inverters were designed to provide emergency standby power for communications links, telemetering facilities and supervisory control equipment. Being static inverters, they may be left switched on continuously with very little load on their power supply, so that full output power is instantly available when needed. A feature of the design is the incorporation of a high speed sensing circuit which detects an ac line failure or a low voltage condition and switches the entire load (up to 16 amperes rms.) in 15 milliseconds.

Featuring components, instruments and equipment designed and manufactured in Canada

This is achieved with a high-speed vacuum relay. Output from the inverter is regulated at 117 v. (±5%) at 60 cps.

R. H. Nichols Ltd., Toronto.

Height-finding radar 105

The first of the height-finding radar units being built for the Pinetree radar line in northern Canada has been shipped from CGE's Royce Works. The units are being produced under a $9-million contract awarded CGE by the Department of Defence Production on behalf of the U.S. Air Force.

Canadian General Electric Co. Ltd., Toronto.

105

Magnetic memory drum 106

Magnetic memory drum type 347 has a 5-million bit capacity for very large volume storage. It incorporates read-write head columns controlled by an air-servo system which assures a constant 0.0006 inch head-to-drum spacing in spite of drum dimension changes due to centrifugal and thermal forces. The drum itself is 18.5 inches in diameter and has a recording length of 22 inches providing 512 tracks.

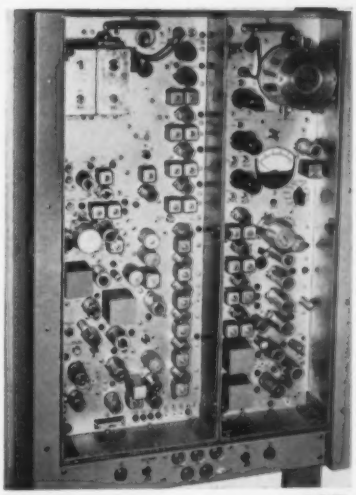
Ferranti-Packard Electric Ltd., Toronto.

106

Radio terminal equipment 107

Type N450 FM radio terminal equipment has been designed for light route communications applications. With the type OJ telephone carrier equipment, it provides service where up to 48 message channels are required. Message channels may be picked up or dropped at terminal or repeater stations separated by distances of up to 45 miles. Operating in the 450 Mc band, interference from mobile radios is not anticipated since the equipment has been designed primarily for remote areas where mobile radios are not in common use. The terminal equipment consists of a transmitter, receiver, power and control units integrally mounted in a standard type telephone equipment bay.

Northern Electric Co. Ltd., Montreal.



107

Silicon rectifiers 108

Production has commenced in Canada on a range of silicon rectifiers for the television and industrial electronics fields. Initially, production will be in the "Top Hat" style in ratings of 1 amp. or lower. Ultimately, this will be expanded to include sizes up to 30-50 amperes. Production techniques centre around a process for producing double vapour diffused junctions. This process is claimed to yield lower forward voltage drops and greater uniformity of reverse characteristics.

Syntron (Canada) Ltd., Stoney Creek, Ont.

Electronic weighing for cranes 109

This crane scale weighs individual loads electronically as they are lifted by an overhead crane in the normal course of production handling or loading and unloading operations. The load is sensed by one or more strain bridge cells fitted to crane hooks or other lifting devices. Precision Baldwin load cells are used and the electronics have been designed to ensure high accuracy, maximum stability and reliability with minimum maintenance. The units are sealed against dust and are of rugged construction to withstand severe operating conditions. Facilities can be incorporated as desired to do any or all of the following: (a) Provide a visual numerical indication of load error. (b) Record individual load weights on a printer. (c) Add a symbol to printed weights for classification. (d) Accumulate weight totals by classification and print sub-totals and final totals.

George Kelk Ltd., Toronto.

For further information on New Product items use the Reader Service cards on pages 83 and 84

New products review . . .

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Stereophonic wireless remote control 110

Model CXR wireless remote control unit permits a listener to balance the level of a stereophonic system while sitting in the normal listening location. A push on the control keys allows balance left or balance right, volume increase or decrease, and also allows the user to turn the entire unit on or off without moving from his chair. The CXR unit consists of a transmitter using two transistors. Operating frequency is 27.200 Mc.; rf power output is approximately 20 milliwatts; nominal am modulating frequencies are 75, 85, 95 and 105 cps. Battery life is greater than one year.

The receiver unit is a five-tube superhet with crystal controlled oscillator. Four relays control the functions, and the function detector is a resonant reed relay. It plugs into any stereo console designed to mate with it.

Illustrated with the wireless remote control unit is the Model S-1000 radio/phono console (The Signature). It has separate AM and FM tuners which can be used for stereo simulcasts. The record changer and arm assembly is a Garrard four-speed laboratory type A automatic changer with 4 lb. die cast turntable and counter-balanced pick-up arm. The infinite baffle enclosures for the speakers include O.G. curves for even distribution of sound.

Clairtone Sound Corp. Ltd., Toronto.

111

TV intercom 111

The SS1026 TV intercom system represents the application of contemporary electronics techniques to the complex problem associated with intercom and audio monitoring in television programming. The equipment is designed to permit the custom engineering of intercom facilities of any desired scope and complexity, using standard modular components which can be assembled, wired and tested prior to installation. Solid state techniques have been used throughout the system, including the switching circuitry. In addition to improved reliability, the use of solid-state components rather than electro-mechanical devices results in sharply reduced maintenance requirements, low power consumption, and fractional space occupancy.

The system involves four main functional elements: power supply circuits, power distribution and control circuits, switching circuits, and input/output amplifiers. The heart of the system is a solid-state switching matrix which determines the routing of the path from any message or program source in the intercom system to the desired destination, and performs the required switching functions. The minimum attenuation in any cross-point is 30 db, so that isolation between any two input/output paths is at least 60 db.

McCurdy Radio Industries Ltd., Toronto.

Peak limiting amplifier 112

Type RA75C peak limiter amplifier, rated at 75 watts and capable of handling peak loads of 125 watts, utilizes a class B modified McIntosh output circuit and offers a new concept in sound system amplifiers. Input facilities include a wide range of impedances for microphone or line, and also telephone-type carbon transmitters. Outputs include 70v line and 600 ohms at 12 dbm.

Northern Electric Co. Ltd., Montreal.

New construction for asbestos cable 113

A new CSA approved construction of type A-16 (A) asbestos insulated cable using an asbestos braid, offers good abrasion resistance and prevents opening up on sharp bends. Also, the low insulation resistance values encountered with the original type when exposed for periods of time to damp or humid conditions have been greatly improved with this new construction.

H. K. Porter Co. (Canada) Ltd., Federal Wire & Cable Div., Guelph, Ont.

Video distribution amplifier 114

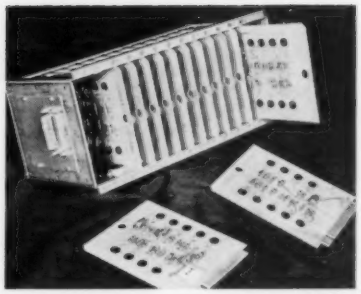
Central Dynamics Ltd. video distribution amplifier Type DIA-1011 has the following specifications: Input impedance of 500 k shunted by 12 pf approx.; gain of -3 to + 15.5 db continuously adjustable; differential gain less than 0.1 db with 1 volt peak to peak output, and less than 0.3 db with 2 volts peak to peak output; differential phase is 0.5 deg. with 1 volt peak to peak output signal; frequency response is ± 0.1 db to 4 Mc; ± 0.25 db from 5 Mc. to 8 Mc.; and less than 2 db down at 10 Mc; output impedance is 75 ohms ± 5%; tilt is 1% at 60 cps; time delay is 30 nano-seconds.

Aeromotive Engineering Products Ltd., Montreal.

Transistor modules and card files 115

A new line of transistorized circuit modules in card form and card files has been developed incorporating high-speed "NOR" logic elements. The logic elements are available for both 200 kc and 1 Mc system operation. Multi-circuit cards may include as many as 9 NOR gates, 4 flip-flops or various combinations of these and other functional elements. Test jacks from at least one point per logic circuit are brought out to the front edge of the card for ease of servicing.

Ferranti-Packard Electric Ltd., Toronto.



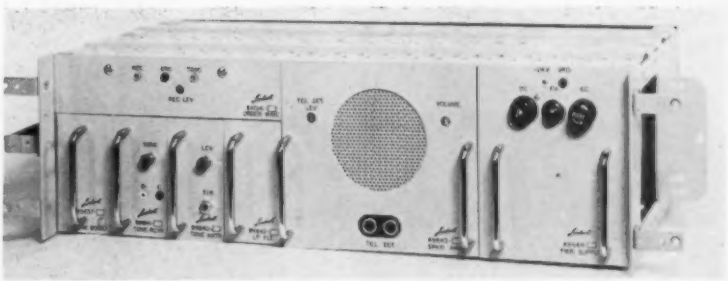
115

116

The Duchess 116

Total peak power is 30 watts (15 watts per channel) in this radio/phonograph combination. Separate AM and FM tuners can be used for stereo simulcasts. The record changer and arm assembly is a Garrard, four-speed, laboratory type "A" automatic changer with 4 lb. die cast turntable and counterbalanced pick-up arm with built-in calibrated stylus pressure adjustments. The cartridge is an Acos "Stereo" model 73-2 with 0.0007 diamond stylus. Frequency response is 35-15,500 cps. There are six speakers: two 12 x 8 in. heavy duty Jensen woofers with four E.M.I. tweeters.

Clairtone Sound Corp. Ltd., Toronto.



120

Automatic temperature control 117

Type PCC thermistor temperature control has been designed for automatic temperature control of water, oils, metal platens, ovens, air ducts, immersion wells, etc. Control is within 1 deg. F., up to 200 deg. F., and 2 deg. F. from 200 to 600 deg. F. The sensing unit is a pre-aged thermistor probe and it may be separated from the control unit by 100 ft. using inexpensive light gauge lead wire. The protected thermistor probe is supplied with mounting hardware, and 3-foot leads which may be lengthened if necessary. A dpdt relay switch for voltages up to 250, handling up to 25 amps is supplied integrally mounted in the control. An electronic bridge circuit amplifies thermistor signals to actuate contacts of the relay. Dual range covers from 0-600 deg. F. and the thermistor probe and bridge circuit are calibrated together for lasting accuracy. The amplifier tube circuit is of the fail-safe variety so that the heat will be shut off in the tube fails.

The Canadian Chromalox Co. Ltd., Toronto.

Paper tape block reader 118

Type 290 block reader is designed to read twelve 8-hole characters in punched paper tape simultaneously. It has a free-run speed of 260 characters per second and a synchronized stop-start speed of 180 characters per second and is suitable for horizontal or vertical mounting. Applications include check-out and inspection systems, numerical control systems and storage system program loading and check-out.

Ferranti-Packard Electric Ltd., Toronto.

TV band rejection filter 119

This band rejection filter has been designed for television viewers in the Toronto area, enabling them to receive channels 7 and 11 without interference from the new station on channel 9. It is available for either 75 or 30 ohm input and has a rejection in excess of 20 db. on unwanted signals.

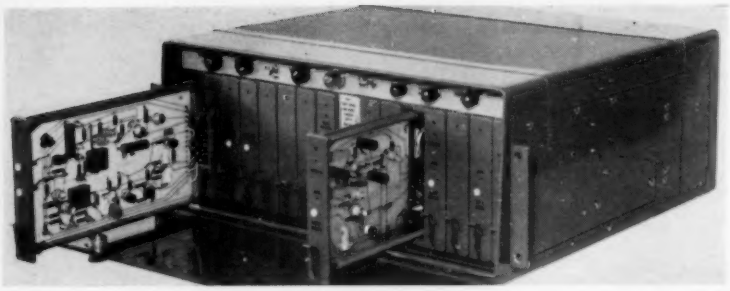
Benco Television Associates Ltd., Toronto.

Order wire assembly 120

Type 84514 order wire assembly will provide economical, flexible and compact order wire facilities for a variety of communication systems. It may be used to combine the supervisory and HF basebands of a communications facility and includes either a 3-way 4-wire, or 4-way 4-wire branching network. The assembly occupies only three mounting spaces of a standard 19-inch relay rack. It provides a self-contained order wire facility which may be arranged for voice calling, tone signalling or a combination of both. A fully equipped assembly includes a terminal board and five plug-in units consisting of a transmitting filter, tone transmitter, tone receiver, speaker amplifier and power distribution or power supply unit. A telephone hand or head set may be plugged into the jacks on the front panel and a hook switch or hanger mounted on the duct trim. Provision is made for operation of the equipment from 115 vac, or 48 or 24 vdc.

Lenkurt Electric Co. of Canada Ltd., Vancouver.

New products review . . .



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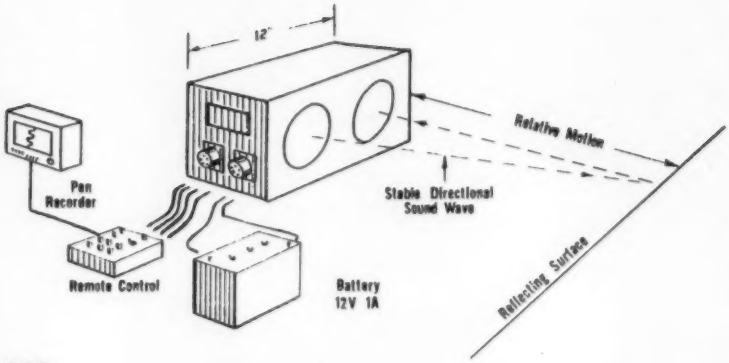

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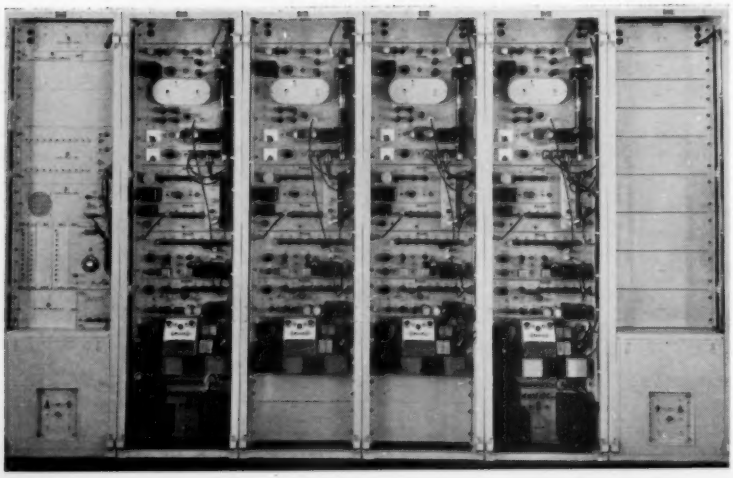


123

Sync generator 121

Type R20861A transistor sync generator produces standard E.I.A. sync generator waveforms for timing and control of mobile or studio television broadcast equipment. Featuring functional, compact design, it can be mounted in just 7 in. of standard 19-in. rack space.

Northern Electric Co. Ltd., Montreal.

Sonic velocity meter 122

Utilizing the Doppler effect, sonic velocity meter type VM 58 can be used to test vehicles such as aircraft and automobiles, or reciprocating machinery such as presses. Basically, the meter consists of an audio transmitter of very high stability which emits a continuous 5,000 cps tone. This is coupled to a receiver which picks up the reflected tone and, by mixing with a portion of the original, obtains a beat frequency which is a precise indication of the frequency shift. There is then a clear and easily calculated relationship between the beat frequency tone and the velocity of the object being tested.

The output from the receiver is recorded by a pen recorder along with a 100 cps reference frequency. From this the velocity can be calculated. The equipment is portable and measures 12 x 6 x 6 in. A 35-ft. cable connects the transmitter/receiver with a control box containing power and monitoring connections, as well as a dc amplifier balancing control. The meter requires 12 to 15 vdc with maximum consumption of 2 amperes.

In one application the sonic velocity meter was used to measure the sink velocity of an aircraft during hard landing tests.

Philco Corp. of Canada Ltd., Toronto.

Microwave relay system 123

Type MM-600-2 microwave relay system incorporates several new design features. It is an integrated group of equipment units which can be used to establish a high channel capacity, long distance comunications network for operation in the UHF microwave frequency band of 1700-2300 Mc. Flexibility of the equipment permits application in a variety of system configurations. The system is designed to comply with CCIR/CCITT performance standards, based on a hypothetical reference circuit system length of 2500 kilometers (1550 miles) and an RF channel capacity of 600 frequency-division

multiplexed voice circuits (60-2540 kc) plus service channels (0.3-20 kc). Alternatively, one RF channel will accommodate 525-line monochrome or NTSC color TV (0-4 Mc), or 625-line CCIR TV (0-6 Mc).

Illustrated is a typical through repeater station installation.

RCA Victor Co. Ltd., Montreal.

Air pollution monitor 124

Air pollution monitor type APM-11 is intended for the detection and continuous monitoring of the presence of smoke, or other air polluting agents. It consists of a smoke density detector, terminal indicator bay (with or without alarm), metal tubes and flanges for mounting in an exhaust sytem. It operates on the principle of comparing two signals, one proportional to the monitored smoke density, the other being a reference signal set in advance to the desired level.

Presentey Engineering Products Ltd., Ottawa.

Pictorial display unit 125

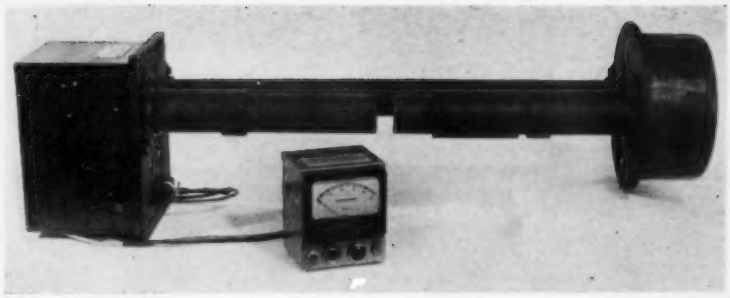
Pictorial display unit type 628 is an airborne instrument intended for cockpit mounting. It receives inputs from a navigation computer system and displays to the pilot continuously on a moving map strip the computed position of his aircraft. A trace is made on the map of the aircraft's movement and with the aid of a joystick the pilot can insert corrections to his observed position at any time in flight, at the same time automatically correcting his navigation computer. Military and commercial versions are available, with auxiliary equipment which permits the display unit to be adapted to a variety of navigation systems.

Canadian Applied Research Ltd., Toronto.

Ringing, talking and signalling supply 126

Model RTS-1 ringing, talking and signalling supply is designed for service in small private telephone exchanges and branch offices, where it provides 20 cps ringing current, 24 or 48 vdc for operating relays or other signalling equipment, 24 or 48 volt talking battery current, and 10 vac for operating signal lamps. The supply has high capacity and can carry full load on all outputs indefinitely.

Pylon Electronic Development Co. Ltd., Montreal.



124

Power converter 127

Power converter type CX130/152A is used to convert battery power of one polarity to dc battery power of opposite polarity, but can be used to step down voltage without changing polarity. Input and output ripple are suitable for telephone service. Input is 130/152 vdc (positive or negative), and output is 130 vdc at 6 amps. (positive or negative). The equipment uses solid state devices and other voltage outputs are available.

Pylon Electronic Development Co. Ltd., Montreal.

Corner reflecting antennas 128

Two corner reflectors have been designed for the 150-174 Mc range for use where a high front-to-back ratio is required. Impedance and pattern are not seriously affected by icing. The feed dipoles are completely enclosed in plastic radomes and VSWR is low over the operating frequency range. Model 227 (illustrated) has a pattern beamwidth in the E-plane of 56 degrees and in the H-plane it is 50 degrees. Gain over a half wave dipole is 7.5 db.

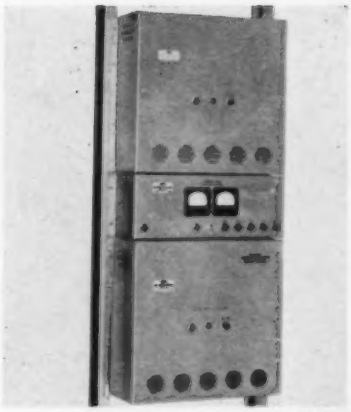
Model 228 has a pattern beamwidth of 43 degrees in the E-plane and 36 degrees in the H-plane. Gain over a half wave dipole is 10.5 db.

Sinclair Radio Labs. Ltd., Toronto.

Thyratron tube tester 129

Model EC 6006 thyratron tube tester can be used to test thyratrons with ratings as high as 100 amperes on a branch circuit fused for only 15 amperes. The tube to be tested is connected in series with a switching device and a current limiting resistor across a 115-volt, 60-cps supply. The switching device, another thyratron capable of passing the required current, is triggered by a circuit which is synchronized with the supply frequency. Operation of the test button on the instrument applies a single trigger to the grid of the switching thyratron at the instant when its anode is going positive. This causes it to conduct for one half cycle which applies voltage to the tube under test. The magnitude of the pulse current is determined by the value of the series resistor. The appropriate resistance value is selected by a switch on the tester. When the tube under test conducts, a voltage appears across it which is a function of the emissive capabilities of its cathode.

Electronic Controls Ltd., Belleville, Ont.



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For further information on New Product items use the Reader Service cards on pages 83 and 84

New products review . . .

Dynamic antenna tester 130

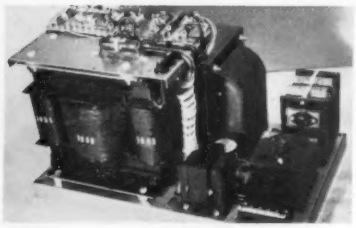
Model 150 dynamic antenna tester checks any 50 ohm antenna at the desired frequency within the range of 150-175 Mc (other ranges available). It contains its own signal generator; measures VSWR directly over the range of 1 to 100; it does not require slotted lines and other bulky equipment; input connector is type N or other as required.

Sinclair Radio Labs. Ltd., Toronto.

Frequency synthesizer 131

This continuously variable frequency synthesizer produces an output frequency from 2 to 30 Mc, with crystal stability and sufficient power for excitation of low level HF transmitter stages.

F. V. Topping Electronics Ltd., Toronto.



133

Delay and linearity test set 132

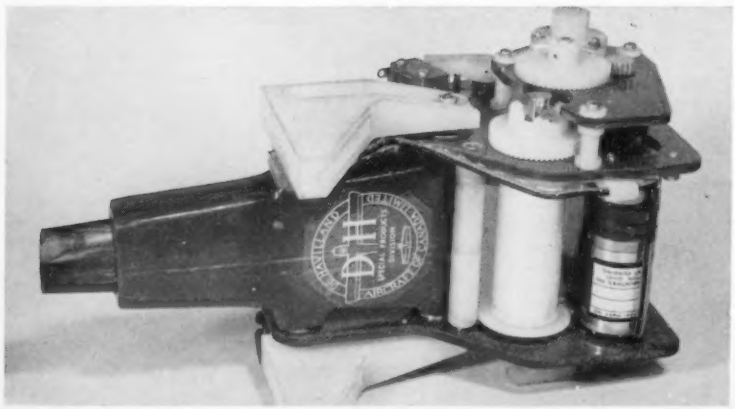
Delay and linearity test set, comprising transmitter type CS-80 and receiver type CS-81, is used for simultaneous measurement of delay distortion (caused by non-linear phase versus frequency characteristics of RF and IF circuits) and modulation/demodulation transfer linearity in high channel capacity microwave relay system. The principle of measurement employed is to apply a swept FM modulated IF carrier to the input of a system and to analyse and display (at the detected output) non-linear phase versus frequency changes that have occurred through the system as an indication of group delay, and amplitude changes as an indication of linearity.

RCA Victor Co. Ltd., Montreal.

Regulated dc power supply 133

This 5-amp., 24-volt, 1% dc regulated power supply has been developed for general laboratory use or battery floating operation. The equipment incorporates current limit and IR line drop compensation. The unit operates as a closed loop servo system by comparing the output voltage with that of a silicon zener diode, the "error" being amplified by a transistor stage. The transistors drive a saturable reactor which provides a series control for the rectifier unit.

Bepco Canada Ltd., Montreal.



136

Portable sound system 134

Designed for fine quality reproduction and reliable operation, the S-115 heavy duty portable console can be used in schools or similar public buildings. There are three units: amplifier-turntable cabinet; loudspeaker enclosure; wooden dolly. The turntable is a Lenco model GL-56, 4-speed, variable speed, semi-professional turntable with queuing facility. There is a Lenco balanced tone arm with Goldring reluctance cartridge. Separate pre-amplifier and power amplifier have a frequency response of 50-20,000 cps; three models are available with ratings of 30, 60 and 100 watts. Two microphone channels with mixing volume controls give the instrument sufficient flexibility to serve as a self-contained public address system.

Barvic Engineering Ltd., Vancouver.

Voltage relay for regulators 135

This static voltage relay is intended to operate step or induction type regulators in place of electro-mechanical balanced beam relays. It employs solid state components and saturable cores. Input voltage may be set between 115 and 130 volts rms with approximately 25 va potential transformer burden. The unit has two output circuits; one is energized when the applied voltage is high, the other when the voltage is low. The differential may be adjusted from $\pm$ 0.2% to $\pm$ 2.0% of the set voltage. In operation, a dc voltage proportional to the rms. value of the applied voltage is compared with that of a zener reference, the difference being amplified by a pre-amplifier. This drives two magnetic amplifiers which form the output stage of the relay.

Bepco Canada Ltd., Montreal.

"Roll-Pole" antenna erection unit 136

The principle of this antenna erection unit is a simple one which can be applied in many different forms for a wide variety of applications, either as a structural mast or as a whip antenna. The antenna is made in the form of a long 2-in. wide tape, preformed into a tube with its edges overlapping to give a tube diameter of approximately 0.45 in. (other sizes are available). Operating much like a carpenter's steel tape, the antenna is initially stored in a flattened position, wound up on a drum. As it is reeled off the drum, the end passes through a sleeve which assists the antenna in taking up its preformed tubular

shape. A Mylar belt, wound on the drum simultaneously with the antenna tape, is used to extend the antenna. Manual or automatic rewind is available and a simple change of the gear train provides a choice in the rate of extension and retraction.

Typical characteristics of units developed for Canadian and U.S. rockets and satellites are: size of 7 x 8.5 x 21 in.; weight of 10 lb.; antenna length of 0-75 ft.; antenna diameter of 0.9 in. Other sizes are available.

The de Havilland Aircraft of Canada, Ltd., Toronto.

Intermodulation test set 137

Intermodulation test set, comprising transmitter type CI-86 and receiver type CI-87, is used for measuring thermal noise and intermodulation noise on multi-channel telephone radio relay or coaxial cable systems. The equipment has been designed to test systems meeting or exceeding CCIR/CCITT performance and the test equipment has been designed to conform with CCIR/CCITT recommendations. The principle of measuring the noise power in a narrow slot in a continuous uniform spectrum of white noise (which occupies the full bandwidth of the system) is employed, thus simulating much more accurately the actual operatng conditions than other measuring techniques.

RCA Victor Co. Ltd., Montreal.

Radar target simulator 138

This equipment has been designed to train operators of airport and airways surveillance radar. It generates synthetically the video signals representing six airborne targets. An instructor has control of turn rate and speed, as well as initial conditions of the six targets. Output video information from the simulator is fed to the surveillance radar display console. Operators of these consoles can then be trained in the control of aircraft using the simulator, or various exercises can be performed to examine new approach and departure patterns.

Raytheon Canada Ltd., Waterloo, Ont.

For further information on New Product items use the Reader Service cards on pages 83 and 84

Educational magnetic amplifier 139

This magnetic amplifier, designed for teaching purposes, has all windings and control circuits brought out to external terminals to enable measurement and experimentation to be carried out easily. The equipment contains two transductor cores which may be connected as a self-excited magnetic amplifier or as a saturable reactor. A dual range adjustable current source is available for connection to any desired number of control windings. A full wave rectifier is normally connected to provide a dc. output current and a switch is available for forward and reverse control current. Choice of control windings is such that they may be used as part of a servo control loop. The unit needs only the addition of two ammeters to carry out experiments into typical characteristics of magnetic amplifiers or saturable reactors.

Bepco Canada Ltd., Montreal.

Static alarm relay 140

This static magnetic amplifier relay was developed to provide audible alarm when the input voltage exceeds a predetermined value. The relay may be used in place of contact making voltmeters or ammeters when alarm or indication of over or under voltage or current is required. The unit uses a silicon zener diode reference and a high gain magnetic amplifier, the set point of which is adjustable. The relay, having an internal resistance of 1 ohm may be adjusted for operation down to voltages as low as 30 millivolts. This corresponds to an "operate power" of 1.8 millivolts. Under the most sensitive condition, the differential is ± 3 millivolts which remains independent of the set voltage at which the relay operates.

Bepco Canada Ltd., Montreal.

Data rate changer 141

This data rate changer is a magnetic tape unit designed to handle information inputs of high speed bursts (130 characters per second) and reproduce at slow speeds (6 characters per second). Variations on these speeds are available. The reading heads are designed for 7-channel operation with ½-in. magnetic tape. The tape loop length is approximately 40 ft, providing a total storage capacity of approximately 12,000 characters. Circuits are provided for reading, writing and control on the back of the panel which is hinged for service access.

Ferranti-Packard Electric Ltd., Toronto.

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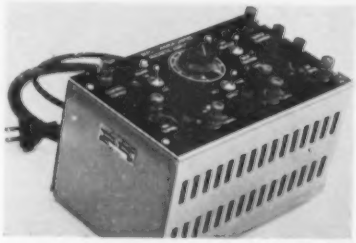

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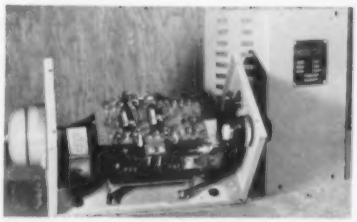

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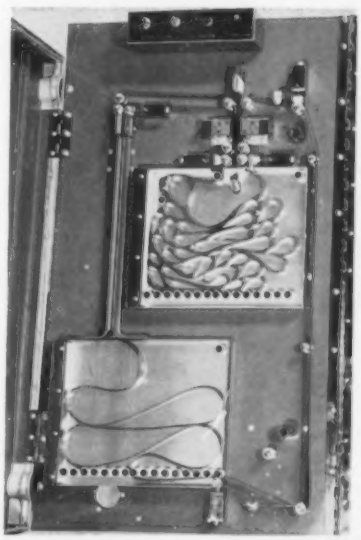
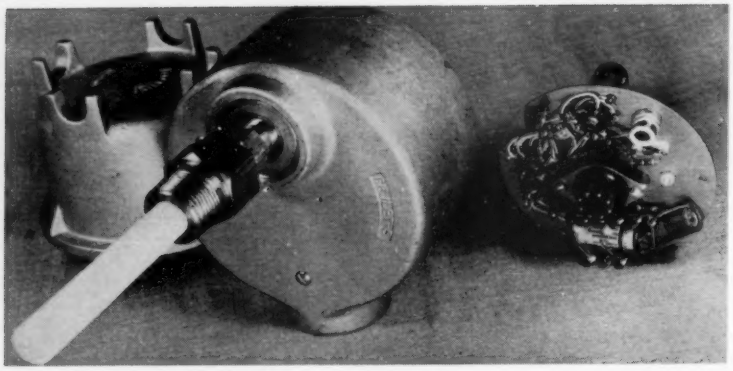


141

New products review . . .



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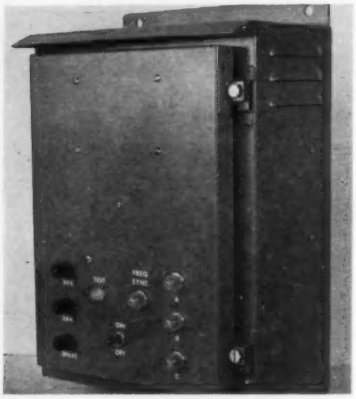


144

Distributed line amplifier 142

Type DLA-46 is a low noise distributed line amplifier with a usable gain of 46 db. It provides reliability associated with this type of amplifier, but by the use of advanced circuitry and high slope tubes of modern design, has much better than usual gain. Since tubes are essentially in parallel, individual tube failures do not render the amplifier inoperative, but show only as a loss in output level. Frequency response is 8-216 Mc gain is 46 db; tilt control consists of three position switch equalizer, 16 db, 13 db and 10 db cut at 55 Mc with maximum deviation of square root of frequency less than ± 1 db maximum output voltage (7 channels) is 0.5 v, rms. peak sync (54 dbmv.).

Delta Electronics Ltd., Clarkson, Ont.

Capacity sensitive detector 143

"Capaswitch", Model 17G1294, is an industrial type capacity sensitive alarm detector. An hermetically sealed relay is operated when the capacitance presented to the instrument probe electrode exceeds a value set by internal adjustment. This adjustment may be set to cause trip action to occur for probe capacitance values up to 63 pf. The instrument differential is 0.5 pf. Temperature compensation applied to the sensing circuit confines shifts in trip point to less than 0.2 pf over the temperature range —40 deg F. to 140 deg. F. Because of its low differential and good stability it has been successfully employed in industry for interface detection between different liquid hydrocarbons or between a hydrocarbon and water in vessels, level detection of various kinds of liquids or granular solids in vessels, and detection of change of materials flowing in pipes.

Fischer & Porter (Canada) Ltd., Toronto.

Shipboard static inverter 144

Type EE-012 shipboard static inverter is designed to provide standby power for a ship's gyro compass in the event of failure of the normal supply. The unit contains means for effecting automatic transfer of gyro load in accordance with the prevailing power situation. From an input of 24 vdc, the unit supplies 240 va at 115 vac (rms), 400 cps, 3-phase. Efficiency is 72%. The unit has been designed and qualified against a number of military specifications.

The de Havilland Aircraft of Canada, Ltd., Toronto.

Microwave radio relay equipment 145

An important feature of the DQ58C microwave radio relay equipment is the use of a varactor as a high level RF mixer driving a single high power travelling wave tube amplifier giving a signal output of 10 watts. The life expectancy of these tubes is at least 150,000 hours, and they can be replaced in the DQ58C to return the system to full operation under 120 seconds. The relay equipment operates in the frequency range 1700-2300 Mc and is intended to carry up to 600 telephone channels to CCIR performances, or one monochrome or NTSC color TV channel. The equipment may be supplied in duplicate with automatic and remotely controlled changeover facilities. Systems can be engineered to provide reliabilities in excess of 99.99%.

Canadian Marconi Co., Montreal.

Corona resistant cable 146

To reduce the effect of corona, a viscous, high temperature and high dielectric strength oil is used to fill the insulation voids in this high voltage cable. Corona discharge produces ozone, a highly reactive, oxidizing gas, which causes deterioration of most organic electrical insulation. When moisture is present, nitrous acid and nitric acid also form and attack most commonly used metals. This new corona resistant high voltage cable reduces the corona discharge.

Boston Insulated Wire and Cable Co., Ltd., Hamilton.

TV standby monitor 147

Designed for use with the model T-1 and T-5 television translator transmitters, this standby monitor unit permits operators to leave transmitter sites unattended for extended periods (6 months or more). If a fault develops in the main transmitter, the standby unit is automatically put on the air and the main transmitter switched off. As a further safeguard, the standby unit is automatically energized each morning when the master TV station is broadcasting a test pattern for a period of approximately five minutes. The operator of the station can, by looking at the test pattern, check on the operation of the standby unit and be sure that it will function correctly if needed. The first system of this type is being installed at North Battleford, Sask.

Benco Television Associates Ltd., Toronto.

Reflex klystron 148

This reflex klystron oscillator operates in the band 68.0 to 74.0 Gc. Features of the tube include single screw tuning over the band, small size, light weight, rugged construction, molded base and leads. It is suitable for operation in airborne and severe environments. A minimum power of 10 mw anywhere in the tuning range is produced with a beam voltage of 2,500 volts.

Varian Associates of Canada Ltd., Georgetown, Ont.

Magnetic recording tape 149

Bel-Clear professional sound recording tape, manufactured in Canada, is available in standard width and lengths. It is also available in special widths and lengths to suit customer specifications. Tape, specially wound on NARB hubs, is available in any desired length on special order.

Sound Electronic Specialties Ltd., Toronto.

Broadband amplifier 150

The Super 36 is a broadband, all channel amplifier, and has application in hotel, motel and apartment house TV installations. It has separate high and low band inputs at 300 and 75 ohms. Each input is fed into a separate amplifier, one covering 54 to 108 Mc (channels 2 to 6 and the FM band), the other 174 to 216 Mc (channels 7 to 13). There is a maximum gain of 35 db on both bands with an approximate gain of 26 db on the FM section. The amplifier will deliver undistorted output of 0.5 v per channel on six-channel operation.

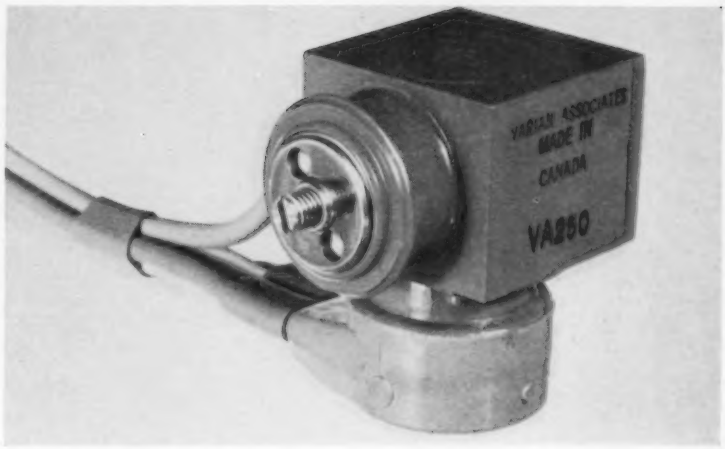
Delta Electronics Ltd., Clarkson, Ont.

Intercom equipment 151

Type M6 master intercom equipment has on/off and calibrated volume control; spring loaded talk/listen switch and 5 slider controls for station selection. Using six type M6 masters in a system, any station may call one or more of the other stations. Six-way conferences, or up to three individual conversations may be held.

In a system consisting of a type M6 master and S6 sub-stations, the master may call any number of sub-stations (up to the maximum of 6) individually or in groups.

Dominion Electrohome Industries Ltd., Kitchener, Ont.



148

Industrial electronic equipment 152

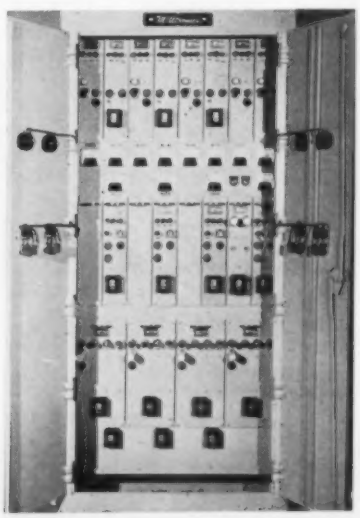
This company specializes in the design and manufacture of industrial electronic control equipment, concentrating on "local loops" of specific equipment to perform in the integrated sections of overall systems.

An example is automation of ore grinding ball mills, which are usually operated manually. Sonic and power evaluation sensors detect the operating conditions within the grinding mill and are matched or compared against "master" settings representing the optimum. Any deviations are detected and, through electronic control circuits, the feed to the mill is varied to maintain the correct ore charge.

Illustrated on the left is the instrumentation panel and electronic control installed in an iron ore pilot mill in Labrador. On the right is shown an electronic control applied to four cement grinding mills—three dry systems and one wet system—in which the uniformity of grind is maintained to ±1%.

Milltronics Ltd., Peterborough, Ont.

(Continued on page 71)



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Some pre-conference planning by the chairman and speakers of Session 6. Left to right: Prof. A Bohr and Dr. B. R. Mottleson, Copenhagen, Denmark; Prof. I. Perlman, Berkeley, California; Dr. P. H. Stelson, Oak Ridge, Tennessee.

International Conference

Scientists discuss nuclear structure

H. E. GOVE, PHD*

Canada played host to physicists from more than twenty-four countries when the International Conference on Nuclear Structure was held at Queen's University, Kingston, Ont. last fall. Much of the discussion concerned models which have been proposed to explain the properties of the nucleus.

Today the major fields of science and engineering are sufficiently interrelated that an important event in one field will have significance in the others. Such an event occurred recently in the field of Nuclear Structure when the International Conference on Nuclear Structure was held at Queen's University in Kingston, Ontario from August 29th to September 3rd last year.

For the first time in history Canada played host to representatives of the International Union of Pure and Applied Physics and to mark the event, three international conferences on different fields of physics were held: at McMaster University a Conference on Nuclear Masses; at the University of Toronto one on Low Temperature Physics; and at Queen's the Nuclear Structure Conference. This latter event was organized by physicists from Atomic Energy of Canada Limited at Chalk River and from the Department of Physics at Queen's University.

Recent conferences on this subject have been held in Amsterdam, Netherlands in 1956; Rehovoth, Israel in 1957; and Paris, France in 1958. They were attended by distinguished workers in the field from all over the world and contributed significantly to our understanding of the way the nucleus is put together and the way it acts under various conditions. The Kingston Conference was no exception. Attended by physicists from more than 24 countries including 80 from Canada, 150 from the U. S. A. and 9 from the U. S. S. R., it dealt with almost all aspects of the subject and left the delegates at the end feeling that, although not all the problems were solved, they were at least more carefully delineated.

*Nuclear Physics Branch, Physics Division, Atomic Energy of Canada Limited, Chalk River, Ont.

Historical background

Ever since the man who can fairly be called the father of Nuclear Physics — Ernest Rutherford, later Lord Rutherford — first demonstrated forty-nine years ago that the atom was a dense nucleus surrounded by a very much larger, tenuous cloud of electrons, the structure of this nucleus has been a matter of great curiosity for physicists. Following Rutherford's monumental discovery came the work of Niels Bohr, who explained how electrons could rotate about the nucleus without incurring radiation losses. The next fifteen years saw great progress in the field and in 1926 a new theoretical concept, quantum mechanics, was introduced by Schrödinger and Heisenberg to explain phenomenon which take place on the atomic scale. Until 1932, however, the constituents of the nucleus were believed to be protons and electrons. In fact, if one consults any chemistry text published in the mid-thirties when most of us attended high school, this concept of the nucleus is found to be the accepted one. In that year, however, James Chadwick — now Sir James — proved the existence of the neutron, and seven years later Hahn and Strassman discovered nuclear fission induced by neutrons. The world has not yet recovered from the consequences of that discovery.

With the realization that the nucleus of an atom consisted of varying mixtures of protons and neutrons, the question as to what kind of force held these constituents together became one that engaged the attention of

nuclear physicists. Although general features of the force such as its non-electrical character and its short range are known, a detailed description is still lacking.

Through the years the tools of the nuclear physicist have undergone radical revisions. With each improved technique (and in this connection the revolutionary developments in the field of electronics have played a role whose importance cannot be overestimated) more refined and detailed information about nuclear structure was revealed. Nuclear properties such as size and shape, the discrete energy states of the nucleus, and the lifetime and total angular momentum of these states, began to be known in sufficient detail for theoretical physicists to try to devise simple models to explain all these properties without requiring the intimate knowledge of nuclear forces, which is still lacking. Much of the discussion at the Kingston Conference concerned these models and their possible interrelations.

Conference program

The Conference, which was divided into nine three- to four-hour sessions, lasted for five-and-a-half days. At each session three or four invited speakers covered specified fields and the remainder of the session (usually one-half to one-third) was devoted to general discussion. The sessions included such general topics as Physical Foundations of Nuclear Models, Gross Properties of Nuclear Matter, Nuclear Reaction Mechanisms, Properties of Individual Levels, Statistics of Nuclear Levels, Fission, and finally a general summary of the Conference by its Vice-President, Professor V. F. Weisskopf, a noted theoretical physicist from the Massachusetts Institute of Technology.

The Conference was opened by its President, Dr. W. B. Lewis of Atomic Energy of Canada Limited. He was followed by Professor R. E. Peierls of Birmingham University and D. H. Wilkinson of Oxford University, who outlined some of the problems in the field which were of immediate concern and to which answers might be supplied by the Conference, or even more likely, supplied by renewed efforts in laboratories throughout the world following the Conference. Then the Conference proper began. Much of the time was devoted to detailed discussions of nuclear models and it is worthwhile describing these in general terms here. There are three of major importance, the shell model, the optical model and the collective model.

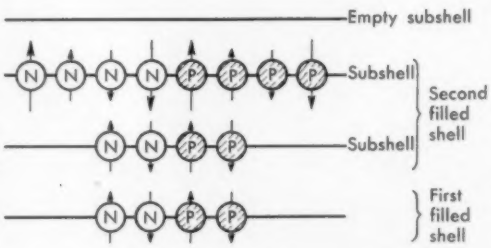
Nuclear models

The shell model stems from much earlier work in atomic physics in which it was found that the electrons in motion around the nucleus could be classified as belonging to various shells. Each electron moves in a given shell under the influence of a central electrical force between it and the nucleus. Forces between electrons provide only a small perturbation on the system. Each shell can contain a fixed number of electrons, and those atoms in which the possible electron shells are filled, are particularly stable. Similar shells exist for nucleons in the nucleus and it is assumed that one must consider only those nucleons which lie in unfilled shells. These will move in a potential field provided by the remaining nucleons in filled shells. The model is capable of making detailed predictions about nuclear properties, particularly for nuclei having only a few nucleons outside a closed shell. For other nuclei, even with the aid of modern high-speed computers, the calculations required are prohibitively laborious.

The optical model was first devised to explain phenomena observed experimentally when a nucleus scatters particles incident on it. In the model the nucleus is pictured as a "cloudy crystal ball"; that is, analogous to a sphere which scatters light but which also can absorb some of the light. Since scattering experiments are widely employed to study nuclear structure the optical model has been tested in great detail and, on the whole, it works surprisingly well, considering that it must be a vast oversimplification of the true situation.

Certain regularities observed in nuclei far removed from closed shells suggested the third model. In this model the many nucleons outside the closed shell have their motions correlated — that is, they engage in some form of co-operative action on the nuclear surface. This collective model also makes many definite predictions about

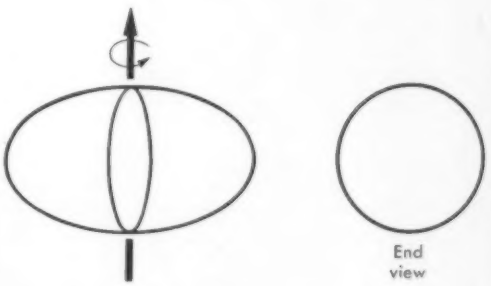
Shell model



Schematic shell diagram for the oxygen nucleus.

Each subshell contains an equal number of protons (P) and neutrons (N). The arrows on each nucleon represent in magnitude and direction the projection of the nucleon's total angular momentum on an axis arbitrarily chosen to be up and down the page. Note that no two protons or neutrons in a particular subshell have the same magnitude and direction for the total angular momentum. If additional neucleons are added, they would have to go into the empty subshell shown — or higher ones.

Collective model



Schematic of one of the collective motions of a nucleus.

In the collective model the nucleus is pictured, in certain cases, as resembling a prolate spheroid (e.g., a cigar). The simplest motion it can execute is to rotate end-over-end as illustrated. If the moment of inertia of the spheroid about this axis is I, then this motion gives rise to a set of states whose energy is proportional to $I(I+1)$.

properties of the nucleus — for example, it says that nuclei away from closed shells are ellipsoidal in shape rather than spherical.

Finally, a great deal of effort is presently being devoted by theoretical physicists to provide a valid theoretical framework on which to hang the various models. Already as a result of their efforts, it is possible to see the connection between the collective and shell model. It is thus possible to regard them, in a sense, as two ways of saying the same thing; one way which allows straightforward calculations for nuclei near closed shells and the other for nuclei lying midway between two closed shells.

Social program

At most conferences it is usual to provide a certain amount of relaxation for the delegates. This creates an opportunity, moreover, to show visitors from outside the country certain aspects of its natural beauty and something of its culture. The proximity of Kingston to the Thousand Island region made it quite natural to plan a boat cruise for the delegates at mid-Conference. Due to almost perfect weather conditions, this proved to be much more successful than the Conference Committee had expected. Beau Rivage — one of the islands off Gananoque belonging to a group included in the national park system — was chosen as the lunch terminus of the cruise. In an atmosphere of bright sunshine, trees and water the delegates were able to continue discussions on conference topics and to relax at the same time.

In addition to this, two concerts were arranged. On Tuesday evening one of Canada's most celebrated sopranos, Lois Marshall, gave a magnificent recital which was enthusiastically applauded by the delegates. After the concert one of the Russian delegates remarked that the concert was a particular pleasure for him since he had been unable to secure tickets to her concerts in Moscow, they were in such great demand. On Thursday evening a concert of Canadian folk songs by Alan Mills and Héléne Baillargeon, was greeted with considerable enthusiasm. Mr. Mills even accomplished the unlikely achievement of persuading the audience to join him in several songs. Two banquets, one provided by Queen's University and the second sponsored by the Conference, and two receptions, completed the social program.

The facilities for such a conference at Queen's University are unexcelled. Many student residences have recently been completed and these provided first class accommodation for the delegates. The main lecture room in Dunning Hall, which is also of very recent construction, is just about perfect for a conference of this size (approximately 400 delegates attended). Meals were taken in the spacious new dining room at Leonard Hall and the propinquity of sleeping, dining and lecture areas greatly intensified the discussions and added to the Conference's success. The Conference was supported by funds from the Government of Canada, from the International Union of Pure and Applied Physics, from the Government of the Province of Ontario, as well as from a good many Canadian industries.

Conference proceedings

One requirement of support by the International Union is the publication of Conference Proceedings. Because the value of such Proceedings in a rapidly advancing field is transitory, the Conference Committee laid considerable stress on getting them published as quickly as possible. To this end the entire Conference was recorded on magnetic tape and the transcript of each day was available the next day for correction by delegates. Within two weeks after the Conference ended the entire Proceedings was typed at Chalk River in a suitable form for photo-offset printing by the University of Toronto Press and three weeks later the 1,000-page volume was in the hands of the delegates. This is a remarkable record which had never been achieved before.

In conclusion, it seems appropriate to quote from the Conference summary by Professor Weisskopf, a passage which could well serve as a maxim for nuclear physicists: "Don't let yourself be talked into believing that the nucleus is not interesting. It is so small and it has so few parts and still it shows a tremendous variety of phenomena. Its investigation requires the whole arsenal of presently available experimental techniques and its understanding makes use of almost all branches of theoretical physics. What a marvellous invention! It is well worth devoting a lifetime to it."

END

Prof. R. E. Peierls, University of Birmingham, was one of the well-known scientists who addressed the delegates.

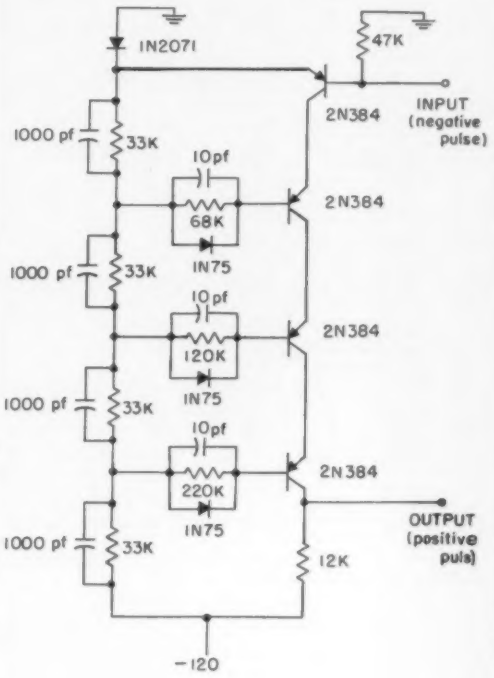
Dr. W. B. Lewis, Atomic Energy of Canada Limited, president of the Conference, formally opened the proceedings.

F. C. CREED, PHD*

Cascaded transistors produce high voltage pulses

Type p-n-p transistors are especially suitable for the generation of steep-front positive pulses; unfortunately, these pulses are usually limited to small amplitudes because of the low voltage rating of suitable transistors. This report describes a method of cascading transistors to produce steep-front positive pulses of any desired amplitude. The circuit produces pulses of 100 volts amplitude, with rise times of 0.05 usec and fall times of 0.5 usec.

Figure 1.



Circuit diagram for four-cascaded transistor pulse generator.

During the course of the development of a special oscillograph, a requirement arose for the generation of a steep front positive pulse of 100 volts amplitude for turning on the oscillograph beam. Since the generation of such a pulse using vacuum tubes requires the consumption of an appreciable amount of standby power, it was felt that the use of p-n-p transistors would be preferable. Unfortunately, the readily available transistors which would be suitable for this application were only rated for 30 volt operation in the common emitter connection, and it was necessary to devise a method by which a number of them could be used in series to obtain the voltage rating required.

Beck published a paper in 1956[1] showing how transistors could be used in series for a high voltage regulated power supply, but apparently little has been done to adapt this scheme for pulse generation. It may therefore be of interest to show how the problem was solved in this case.

Figure 1 shows the circuit for an arrangement using four transistors in cascade, although any number may be used. The top transistor is biased to cutoff by the voltage drop across the silicon diode, and consequently no current can flow through any transistors. The voltage divider sets the voltage for the base of each transistor, and since none of them is conducting, the emitters are at the same potential, as the bases, and the supply voltage is evenly distributed across all the transistors.

When a negative pulse is applied to the base of the top transistor, it switches to the conducting state so that the collector voltage rises toward ground. This in turn causes the emitter of the second transistor to rise above its base voltage so that it is turned on. The process continues down the entire string so that all of the transistors switch rapidly from the cutoff condition to the conducting condition. This results in only a few volts drop across each transistor so that most of the supply voltage appears across the resistor from the last collector to the negative supply voltage.

(Continued on page 55)

*National Research Council, Radio and Electrical Engineering Division, Ottawa.

Patent news

Scientists in Government agencies such as National Research Council and Defence Research Board frequently invent circuits or devices having commercial application. In such cases, patents are taken out and made available to industry. CEE has arranged to publish bi-monthly news about such patents. Persons interested in obtaining licences should contact Canadian Patents and Developments Ltd., 100 Sussex Dr., Ottawa 2, Canada.

Narrow band filter circuit

Case No. 2816

Inventor: Donald S. Smith

This invention originated in the laboratory of the Division of Applied Physics at the National Research Council, Ottawa, as a solution to a particular problem in interferometry. A patent has been applied for in the U. S. A.

The invention relates to an electric circuit, the principal function of which is to perform as a narrow band filter to discriminate between a received signal of predetermined frequency and surrounding noise. The circuit may also be simultaneously employed as a frequency translator, that is a device for converting a signal received at one frequency into a corresponding output signal at a different frequency.

Application

The main purpose for which the invention has been developed is the detection of a comparatively weak signal received together with such a large volume of noise that detection of the signal is difficult or unreliable with existing apparatus, or else requires elaborate and expensive devices to eliminate the noise. The principal object of the invention may thus be expressed as the provision of a circuit that can detect the presence of a signal buried in noise by means of simple, inexpensive and reliable apparatus. In particular, it is an object to avoid the use of electronic devices and to rely solely on the more robust circuit elements readily available to the engineer.

The requirements to discriminate between a weak signal and surrounding noise is often met with a servo systems, which is one reason why the present invention is expected to find useful application to such systems. Another reason resides in the frequency translating properties of the present circuit. The signal frequency in many servo systems is quite low, for example 15 cps, and this is often not a very convenient frequency for use directly in the instrument to be controlled. Thus the facility of the circuit to act simultaneously both as a narrow band filter for detection of the signal and also as a frequency translator to feed out the signal at another, more preferred frequency, renders it especially well adapted for use in servo systems. Nevertheless, as will be readily apparent from the description which follows, the circuit may have other useful applications whenever the properties of a narrow band filter are desired, and especially when these properties are required to be combined with those of a frequency translator.

As has been explained, the frequency translating feature is useful in converting from a low frequency such as 15 cps to a more conveniently usable frequency (say, for example, 400 cps). A specific aspect of the frequency translating properties of the circuit according to the invention is its ability to receive a dc signal buried in noise as an input, and to deliver an ac signal of a selected frequency as an output.

The circuit according to the invention in its broad scope comprises a dynamometer type meter movement having a fixed coil and a movable coil arranged with their field directions normally intersecting in quadrature; a balanced bridge, one arm of which includes one of the coils (preferably the moving coil); means connected to the other coil for applying a reference voltage of predetermined frequency; means for applying the signal with accompanying noise across one diagonal of the bridge to deflect the moving coil as a result of interaction of the fields of the signal and reference voltages; and means for detecting the output voltage across the other diagonal of the bridge. This output voltage is generated in the first coil by transformer effect from the second coil, but is comparatively insensitive to the signal and noise by virtue of the balanced state of the bridge.

When the frequency translating facilitiy is required the circuit also includes means for applying a second reference voltage to the second coil at a second frequency different from the first, predetermined frequency. The output detecting means may then include a device, such as a filter, for discriminating between this second frequency and the predetermined frequency. In this way the second frequency can be substituted in the final output for the predetermined frequency which is necessarily that of the signal.

The circuit shown includes a meter-like movement MM comprising a fixed coil F and a movable coil M. These coils are arranged similarly to the coils in a zero-centre, dynamometer type wattmeter, with the field of the moving coil M intersecting the field of the fixed coil F in quadrature, at zero deflection of the movement. The moving coil M is connected as one arm of a bridge, the other arms of which are formed by a dummy impedance Z which matches the impedance of coil M, and the two halves of the centre-tapped primary of an output transformer T.

The signal (and noise) are impressed across bridge diagonal terminals S, connected between the centre tap C of the transformer and the junction J of coil M and impedance Z. Let it be assumed that the signal to be detected has a frequency of 15 cps. A reference sine wave frequency of 15 cps or equivalent is then impressed across terminals R by oscillator O. Terminals R are connected to coil F. In the absence of a signal, the movement will not deflect, since a high degree of frequency correspondence between the currents in coils F and M is necessary for any deflection to take place. The movement will preferably be given a long time constant by means of oil damping, so that any momentary correspondence in phase between currents in coils F and M will be ineffective to produce deflection.

However, as soon as a signal at the correct frequency appears across terminals S, and hence in the coil M, the currents in coils F and M will cause the latter to deflect in exactly the same way as takes place in a standard wattmeter. It is, of course, preferable that the currents in coils F and M be in phase with each other, or 180 deg. out-of-phase with each other. The direction of deflection will depend on this phase relationship. At any intermediate phase relationship, the response will be reduced, but will

always be present except when the currents are exactly 90 deg. out-of-phase. Thus, for maximum response, a 0-deg. or 180-deg. phase relationship is desirable.

Neither the signal nor the noise received across terminals S will theoretically appear across the output terminals of transformer T, which reflect the voltage across the other bridge diagonal, since the bridge is balanced and equal and opposite currents will flow in the two halves of the primary of the transformer. In practice, a small amount of noise may get through to the secondary of the transformer, but this can be disregarded.

Whenever the moving coil M is deflected by a signal of proper frequency, there will be induced in the coil M by the fixed coil F a voltage at the reference frequency (15 cps) proportional to the deflection of coil M. The current which flows in response to this induced voltage will traverse the entire primary of the transformer T in only one direction and thus will induce a corresponding output voltage at the reference frequency across the transformer, which will be detected in amplifier A.

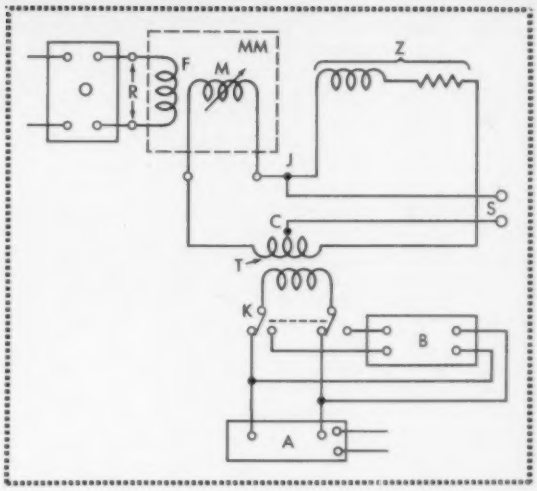
It will be seen that the movement MM constituted by coils F and M acts simultaneously in the two capacities of meter movement (to discriminate between a signal at the reference frequency and noise at other frequencies) and variable transformer (to induce a secondary voltage in coil M proportional to its deflection and hence proportional to the input signal). In many practical applications it is the mere presence of a signal terminals S that is required to be detected, without regard to its amplitude. However, the present circuit provides an output proportional in amplitude to the amplitude of the input, so that quantitative detection can be obtained if desired. Furthermore, the phase of the output will reflect the phase of the input.

As so far described, the circuit functions essentially as a narrow band filter. In practice a bandwidth of approximately 0.03 cps has been obtained.

Frequency translation

Now assume that two reference frequencies are applied simultaneously by oscillator O to terminals R. One of these reference frequencies must be the same as the signal frequency, for example 15 cps, and the other can be a frequency (say 400 cps) chosen for convenience of further use. When a signal appears across terminals S at the first reference frequency, the coil M will deflect as before, but now secondary voltages will be induced in coil M at both frequencies. These secondary voltages will ultimately appear across the secondary of transformer T and may then be passed by switch K through a conventional filter B to output amplifier A. Filter B will remove the 15-cps signal so that only the 400-cps signal appears at amplifier A. In this way the circuit has received a 15-cps signal buried in noise as its input and delivered a proportional 400-cps signal, substantially free of noise, at its output, thus combining the functions of narrow band filter and frequency translator. Quite often in practice a filter can be dispensed with, since the characteristics of the utilisation circuit will often be such that it will only accept the required frequency. Also it should be appreciated that, if two frequencies are widely separated, as in the example of 15 and 400 cps, the 400-cps frequency tends to dominate in amplitude at the output, because of the inherent filter action of the transformer which better transmits the higher frequency.

If the signal to be detected is dc, then use of a double reference frequency is essential. To deflect the coil M, there must be a direct current field (zero frequency), while to obtain the transformer effect there must be an alternating current field. The direct current field can be obtained in any convenient way, for example from a permanent magnet mounted in the meter movement, or by including a rectifier in the cabinet with the oscillator O and mixing the direct current so obtained with the normal output of the oscillator. The output at amplifier A will then occur at the selected alternating current reference frequency.



Alternative circuits

In another version of the circuit, a pair of matched resistors are substituted in the arms of the bridge for the primary of the transformer. The bridge remains balanced, thus substantially eliminating the signal and noise from the output, as before, while permitting the voltage induced in moving coil M at the reference frequency or frequencies to appear across this output.

In both examples of the invention described, the reference voltages have been applied to the fixed coil F while the movable coil M has been included in one arm of the bridge. These functions can be reversed, if desired, the reference voltage or voltages being applied to the moving coil and the fixed coil being connected in the bridge. Moreover, any other balanced bridge arrangement may be employed provided it is such that the incoming signal (and with it the noise) does not appear at the output, while the voltage generated by transformer effect in the meter movement does appear at the output.

Voltage regulation circuit

Case No. 2798

Inventors: Dr. C. A. Franklin and P. M. Thompson

This invention originated in the laboratories of the Defence Research Telecommunications Establishment, Ottawa. It arose from the development by DRTE of an airborne Doppler navigation system. Patents have been applied for in the U. S. A., Canada, and the U. K.

The invention relates to a voltage regulation circuit for a power supply and is particularly concerned with a shunt voltage regulator.

One form of shunt voltage regulator depends for its operation on an impedance placed in series with the power supply and on a group of constant voltage drop devices, such as voltage regulator tubes or avalanche mode diodes, placed in series across the terminals of the power supply.

The group of series connected elements forms a current shunting path through which that current provided by the power supply, and not required by the load, is shunted. This shunt voltage regulator has a relatively high output impedance, and if avalanche diodes are used the voltage regulator becomes temperature dependent.

Another known shunt voltage regulator uses a variable impedance device such as a tube or a transistor connected across the output. This variable impedance shunt regulator is limited in the voltage which it can handle by the permissible voltage difference across the variable impedance device.

The present invention provides a shunt voltage regulator that has both the low output impedance and stability of the second type of known regulator and the extended range of output voltage of the first type. Such a voltage regulated power supply comprises a source of direct current voltage having a pair of terminals, a pair of output terminals for supplying a regulated direct current voltage to a load, one terminal of the source being connected to one of the output terminals. A resistor is connected in series between the other terminal of the source and the other output terminal. A voltage divider is connected across the output terminals. A source of constant direct current reference voltage is provided together with means for comparing the voltage drop across a portion of the voltage divider and the reference voltage. A group of constant voltage drop devices are connected in series between one output terminal and the collector of a transistor. The emitter of the transistor is connected to the other output terminal and means are provided for supplying an input signal to the base of the transistor in accordance with the difference between the voltage drop across a portion of the voltage divider and the reference voltage, to regulate the potential difference between the output terminals.

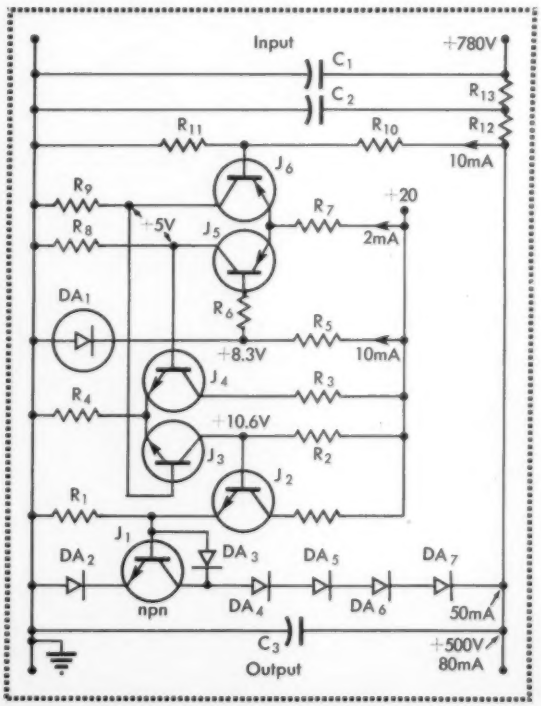
This voltage regulator achieves the stability of a conventional regulator using regulator tubes and is more flexible in that it will accommodate a wider range of voltages and load variations than previous regulators.

The diagram illustrates an embodiment of the invention in which a pair of input terminals are provided for an unregulated input from a source of direct current voltage, and a pair of output terminals are provided which operate to provide a regulated output voltage to a load.

The avalanche diodes (or VR tubes) DA3 to DA7 inclusive are connected in series across the output terminals. In addition, a transistor J1 is connected in series between ground and the avalanche diodes DA4 to DA7 inclusive. Variations in voltage appearing at the output terminals appear across the voltage dividing network consisting of R10 and R11, and are compared with the voltage drop across reference diode DA1 by a difference amplifier of conventional design amplified by a conventional amplifier consisting of transistors J2 to J6 inclusive, and provide a driving signal for the base of transistor J1. Consequently, any variations in output voltage which the avalanche diodes (or VR tubes) fail to correct will result in a variation in the current being passed by J1 which will tend to offset these variations.

An avalanche mode diode DA3 is connected between the collector and base of J1 to protect the transistor from the damage which might occur due to an excessive voltage appearing between its emitter and collector. Such an excessive voltage would cause conduction of DA3; this would switch on J1 and the voltage from its collector to its emitter would be reduced.

Consequently, a regulator is provided which has the high degree of stability of the amplifier type of regulator, with a much higher voltage limitation.



Current overload protective circuits

Case No. 2799

Inventors: Dr. C. A. Franklin and P. M. Thompson

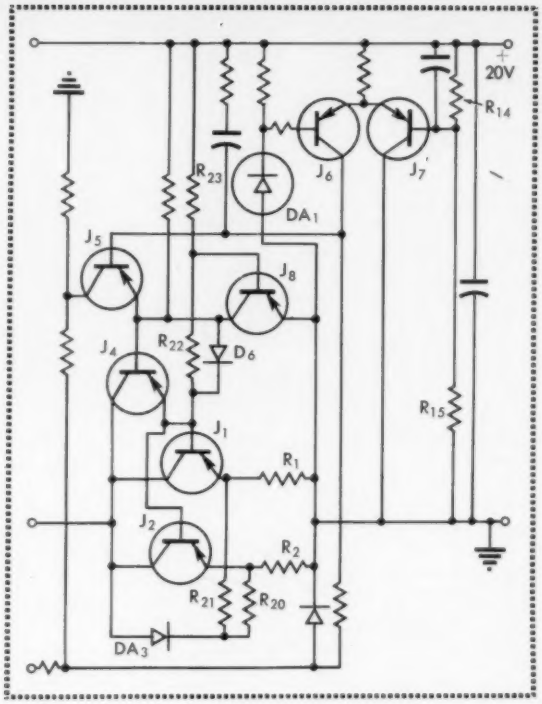
This invention also originated at DRTE, arising from the airborne navigation system development. Patents have been applied for in the U. S. A., Canada, and the U. K.

The invention describes an overload protection circuit for a transistor amplifier.

Transistors are often used as variable impedance devices where the current from the emitter to collector is controlled by the current supplied to the base. If the current capacity of a single transistor is insufficient, it is common practice to connect a number of transistors into a parallel combination capable of handling the required current. An application of this type occurs in a series voltage regulator for a power supply.

Known protective devices for limiting the current passed by such a group of transistors have maintained the total current within safe limits. It is a fault of such systems, however, that one transistor with characteristics different from the others may pass an excessive current and be destroyed in spite of the protective device. The overload protection provided by this invention eliminates this danger, for it operates if an individual transistor of the group conducts too much current.

One embodiment of this invention is illustrated in the diagram, which shows the voltage regulator circuit of a transistorized power supply. R14 and R15 form a voltage divider across the output terminals and the voltage between them is compared with the voltage across a reference avalanche diode DA1. The difference is amplified by the transistors J6 and J7, and applied to the base of transistor



amplifier J5 which is coupled to transistor J4. J4 controls the conductivity of J1 and J2 to maintain the output voltage constant. Resistors R1 and R2 help to equalize the currents through J1 and J 2.

The protective device which safeguards transistors J1 and J2 is the transistor J8, which is normally cut off by the bias voltage across R22. If either J1 or J2 passes an excessive current, however, a voltage is developed across R1 or R2 which appears at the common base connection and switches on J8. The collector current of J8 then limits the signal driving J1 and J2.

In normal operation the regulator will maintain the output voltage at its proper level until J1 and J2 overload, whereupon the output voltage will fall and the current through J1 and J2 will be reduced. If the output terminals are short circuited, the bias applied to transistor J8 by resistors R23 and R22 is removed. The voltage developed across the resistors R1 and R2 will cause J8 to saturate, thus switching off J1 and J2 very quickly.

The operation of this protective circuit is insensitive to temperature variations because any temperature change which reduces the work functions of the base-emitter junctions of J1 and J2 will likewise reduce that of transistor J8. J1, J2 and J8 are exposed to the same ambient temperature.

Diode D6 is normally non-conducting and will conduct only when the output terminals are subjected to heavy overload or are short circuited. Under these conditions, J8 saturates and passes a high current; J8 is in no danger itself because the voltage existing between the collector and emitter is of the order of a volt and little power is dissipated.

The resistors R20 and R21 provide a path for current to flow from the output to the collectors of transistors J1 and J2 other than through the output transistors. This is often necessary when a non-linear load is connected between the output terminals. Diode DA3 may be replaced by a short circuit if the regulator is not required to function over a wide range of current (e.g. more than 5:1).

Pulse generator — continued

The entire string of transistors remains in the conducting state as long as the top one is conducting, with the individual base resistors controlling the amount of base current drawn by each. When the top transistor is cut off by removal of the negative pulse, the collector voltage of this transistor drops as long as the remaining transistors are in the conducting state. This lasts until the emitter of the second transistor drops to the level of the voltage supplied to its base. At this point, the second transistor is cut off and its collector continues to drop in potential until the third transistor is cut off. The process continues down the string until all of the transistors are cut off, and the original voltage distribution is obtained.

It is necessary to ensure that the bases of the individual transistors are not permitted to drop below the potential of their bias supplies, otherwise a transistor above would have an excess voltage across it. This is accomplished by means of the 1N75 diodes which limit the lower excursion of the bases of the bottom transistors, thus ensuring that no transistor has more than its rated voltage applied across it. The small capacitors shunting the base resistors help speed up the switching process by preventing the potentials of the bases from rising as fast as the potentials of the emitters.

The circuit shown has been used successfully to generate positive pulses of 100 volts amplitude with a rise time of 0.05 usec. This is very close to the rise time obtained when a single common emitter stage is used. The degradation of response produced by the added transistors is small because they are operated in the high-speed common base connection. The length of the output pulse is determined by the length of the actuating pulse applied to the base of the top transistor, and the circuit will operate with pulses as short as a few nanoseconds or as long as desired. The rate of fall of the pulse during the switch-off period is appreciably longer than the rise time, as seen from Fig. 2. Here the tail of the pulse has a fall time of approximately 0.5 usec. This, however, is no disadvantage for the purpose for which the circuit was designed. END

REFERENCE:

1. K. H. Beck, "An n-stage series transistor circuit", Trans. IRE, Vol. CT-3, No. 1, pp 44-51, March, 1956.

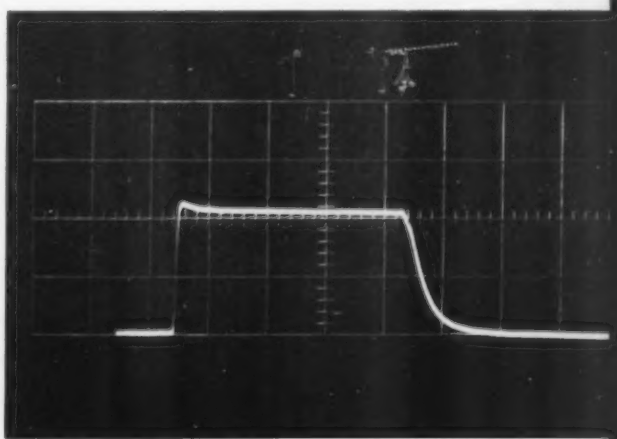


Fig. 2. Output pulse from four cascaded transistors. Horizontal defl. 0.5 usec/div. Vertical defl. 50 v/div.

Dr. Lloyd V. Berkner to address IRE Canadian Conference banquet

Dr. Lloyd V. Berkner, newly-elected president of the Institute of Radio Engineers will be guest speaker at the IRE Canadian Electronics Conference banquet in Toronto October 3. He will speak on a subject appropriate to the theme of the conference, "Progress through electronics."

This year the banquet will be held in the Queen Elizabeth Dining Room at Exhibition Park, Toronto.

Dr. Berkner is now president of Associated Universities, Inc., New York, N.Y. He recently served on national and international committees for the International Geophysical Year. He was prominent in an IGY meeting held on the University of Toronto campus in 1957.

Dr. Berkner received the BSEE degree in 1927 from the University of Minnesota, which in 1952 honored him with the Distinguished Alumni Award. From 1933-35 he studied physics at the George Washington University. He holds a number of honorary Doctorate degrees from universities in Europe, Asia and North America.

While still an undergraduate, Dr. Berkner was engineer-in-charge at radio station WLB-WGMS, Minnesota. For one year after graduation he worked as an electrical engineer for the Airways Division of the U. S. Bureau of Lighthouses. He was an engineer with the first Byrd Expedition to the Antarctic in 1928-30, and was awarded the U. S. Special Congressional Gold Medal, the Silver Medal of the Aeronautical Institute, and the Gold Medal of the City of New York for his services. For three years thereafter he was on the staff of the National Bureau of Standards. From 1933-41 he was a physicist with the Department of Terrestial Magnetism of the Carnegie Institute of Washington, and during 1940-41 he was a consultant to the National Defense Committee.

An aviator in the Naval Reserve since 1926, Dr. Berkner was called to active duty as head of the Radar Section, Bureau of Aeronautics, in 1941. He directed the Bureau's Electronics Materiel Branch from 1943-45, and served on the U.S.S. Enterprise in 1945. He has held the rank of Rear Admiral, USNR, since 1955.

During 1946-47, Dr. Berkner was Executive Secretary of the Research and Development Board and remained a consultant to the Board until 1951. He was head of the Section on Exploratory Geophysics of the Atmosphere, Department of Terrestrial Magnetism, Carnegie Institution, from 1947-51. Since 1951 he has been President of Associated Universities, Inc., New York, an educational institution which operates such research facilities as the Brookhaven National Laboratory under contract with the U. S. Atomic Energy Commission and the National Radio Astronomy Observatory under contract with the National Science Foundation.

Dr. Berkner has held numerous offices and advisory positions in government, industry and education. In the State Department he served as Special Assistant to the Secretary of State, and Director of the Foreign Military Assistance Program in 1949, and Chairman of the International Science Steering Committee which produced the report "Science and Foreign Relations." Recently he was prominent on national and international committees of the International Geophysical Year. He is presently a member of the Board of several industrial organizations. He was formerly a member of the President's Science Advisory Committee, and at the expiration of his term became consultant to the committee.

Dr. Berkner received the Science Award of the Washington Academy of Sciences in 1941; Commendation Ribbon of the Secretary of the Navy in 1944; Honorary Officer, Order of the British Empire in 1945; U. S. Legion of Merit in 1946; and Alumni Recognition Award of Acacia Fraternity in 1954.

He is Chairman of the Space Sciences Board of the National Academy of Sciences, past President of the International Scientific Radio Union, past President of the International Council of Scientific Unions, and a former member of the Executive Committee of the International Union of Geodesy and Geophysics. He is a member of the National Academy of Sciences and of the American Philosophical Society, President of the American Geophysical Union, and a Fellow of the American Academy of Arts and Sciences, the Arctic Institute of North America, The Institute of Radio Engineers, and the New York Academy of Sciences. He is a Foreign Fellow of the Royal Swedish Academy of Sciences and holds membership in numerous other professional and honorary societies in the United States and abroad.

This marks the start of a new department in Canadian Electronics Engineering. "IRE News" will present information about the activities of the Institute of Radio Engineers in Canada.

IRE-EIA liaison strengthened

Liaison between manufacturers and engineers has been strengthened for the IRE Canadian Electronics Conference. The Electronic Industries Association of Canada will be represented on the Executive Committee of the conference.

First appointee as EIA representative to the committee is Stuart D. Brownlee, immediate past president of EIA.

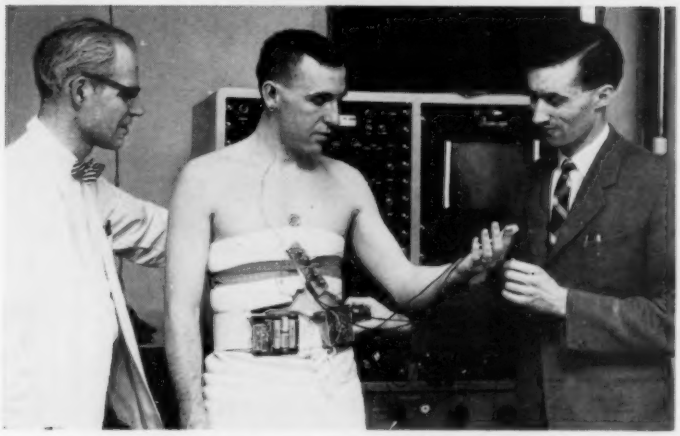
This new liaison supplements and strengthens existing links. Ralph A. Hackbush, Director of Engineering of EIA, sits on the conference's Advisory Committee and Eric Palin represents the Institute of Radio Engineers in liaison with EIA.

Section activities

During the IRE Communications Symposium, held in Montreal last Fall, chairmen from several Canadian IRE Sections held a meeting to discuss mutual problems and affairs. A number of interesting comments were made regarding meetings held throughout the year by the Sections.

Ottawa Section fosters the international aspect of IRE by exchanging visits with Syracuse Section. Student

(Continued on page 60)



R. Cobbold, right, adjusts equipment designed to measure and transmit information about condition of the heart. Wearing the new portable equipment is Dr. D. Bailey. At the left is Dr. J. E. Merriman.

Treadmill in cardio-pulmonary laboratory, University Hospital, Saskatoon, is used to test new heart research equipment.

Instruments aid heart research program at University of Saskatchewan

A new era in heart research has started at the University of Saskatchewan in Saskatoon.

The heart rate of athletes during violent exercise has been monitored through use of small equipment worn by the athletes. The next step is to develop equipment that can be worn by heart patients to enable their daily routine to be checked by their doctor.

The projects are under the direction of Dr. J. E. Merriman, assistant professor of medicine and director of the Cardio-Pulmonary Laboratory at the University Hospital. Co-operating are B. A. Holmlund and R. Cobbold of the College of Engineering and Dr. W. A. R. Orban and Dr. Don Bailey of the School of Physical Education.

In experiments held already, an athlete has carried equipment on a belt, with electrodes fastened on his skin near his heart. The equipment consists of a miniature radio transmitter, electrocardiographic amplifier and batteries. It records some of the electrical impulses of the heart—not as many as the standard electrocardiogram, but sufficient to give a record of the heart rate.

The significant part of the experiments has been that the signals have been relayed over distances of up to one mile to a conveniently located receiver where they were tape-recorded. Later, the recordings were analyzed.

Adapting the technique to everyday situations for heart patients will necessitate some changes to the equipment so that more information can be transmitted over longer distances. In other words, so that a complete electrocardiogram can be taken and transmitted for recording at the doctor's office.

With this situation, Dr. Merriman said, it appears possible that a doctor would know exactly the type of activity his heart patient should avoid.

In tests with athletes that are continuing on a regular basis, Dr. Merriman and his colleagues are getting a good idea of what the normal heart can do, and they are learning something of the benefits of exercise to the heart.

The heart research is the direct result of the University's decision last year to take advantage of the contributions medicine and engineering can make to each other. The University set up a lectureship in bio-medical engineering, the first of its type in Canada. Mr. Holmlund was appointed to the position, and acts as a liaison between the Colleges.

The light equipment used in the experiments was designed and built in the College of Engineering under the direction of Mr. Cobbold. The College will be responsible for developing more advanced units.

Sessions set for ISA conference

Program organisers of the 1961 Summer Conference and Exhibit of the Instrument Society of America have announced a preliminary list of session topics. The Conference will be held in Toronto, June 5-8.

Included in the sessions are: Chemical and petroleum instrumentation; Power instrumentation; Automotive instrumentation; Pulp and paper instrumentation; Metals and ceramics instrumentation; Feedback control systems; Underwater instrumentation; Analysis instrumentation; Data handling and computation; Measurement and control instrumentation; Physical and mechanical measurement instrumentation.

Papers for these sessions are still being accepted and anyone wishing to submit a paper should do so right away. Send paper titles and a brief summary to Mr. J. S. Bennett, Technical program chairman, 1961 Summer Conference and Exhibit, Instrument Society of America, c/o Moore Instrument Co. Ltd., 169 McCormack St., Toronto.

Canadian Controls & Instrumentation

In November 1961, Maclean-Hunter Publishing Co. will publish the first annual number of a new business publication, Canadian Controls & Instrumentation. It will be edited for engineers and technicians in Canadian industry engaged in the manufacture and use of controls and instruments.

CC&I will report on the latest developments and trends in the growing field of industrial control and instrumentation, with emphasis on applications and new technologies.

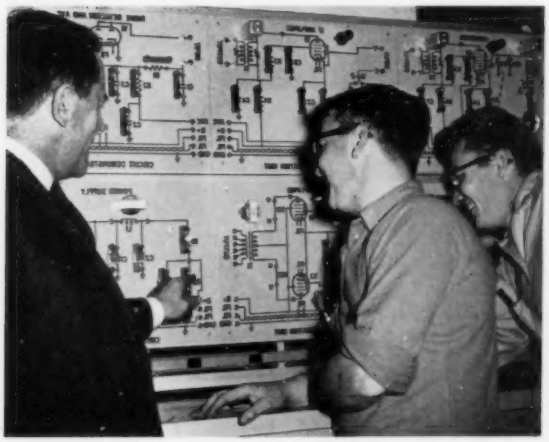
Engineering meetings keep electronics people busy during winter months

General Instrument Ltd. held a symposium in Toronto to introduce the products of its semiconductor division to Canadian engineers. Editor Harold Price, left, discusses components with John McKerrow, division manager and J. McK. McLean, vice-president and general manager.

Ryerson Institute of Technology, Toronto, played host to members of the Toronto Section of IRE last month. Visitors were shown laboratories and studios of the newly-opened engineering building. At left, Ryerson staff members, R. Low, centre, and Dr. P. Byrne watch a student setting up a demonstration. The pulse circuits laboratory is shown above.

G. Sandford, centre, shows model of linear electrical pump used during his prize-winning talk at Toronto AIEE-IRE student papers competition. With him, left-to-right are: E. F. Connolly, AIEE judge; J. Duffin, second prize winner; W. H. Prevey, AIEE judge; R. J. A. Turner, IRE judge; R. Beamish, third prize winner; D. E. Coulman, fourth prize winner. Mr. Coulman is a student at Ryerson Institute of Technology; the other three students are from the University of Toronto.

At the 3rd annual dinner of the Canadian Astronautical Society, president P. A. Lapp described progress of the society with its library, research and international liaison projects. Guest speaker at the dinner was Dr. V. B. Mean (left), Royal Ontario Museum, who spoke on explorations of the Chubb Crater.



Canadian National Telecommunications, with a contract to maintain the $25-million Grande Prairie — Alaska microwave link, has established a technician training school in Edmonton. CNT employees are given a 16-week course of classroom and laboratory work. Gordon Smith, CNT's microwave systems instructor, heads up the school.

Alpha Aracon Radio Co. Ltd. and Tung-Sol Electric, Inc. held seminars in Montreal and Ottawa for engineers and purchasing agents of industrial firms. Shown l-r are L. McNabb, sales manager of Abbey Electronics Co. Ltd.; R. Veiser, C. F. Rork and R. Logan of Tung-Sol Electric; S. Applebaum, vice-president of Alpha Aracon Radio Co.

For your library

Two texts are complementary on subject of statistics

Introduction to Probability and Statistics

B. W. Lindgren and G. W. McElrath; Brett-Macmillan Ltd., Galt, Ont.; 277 pp; $6.25

Statistics Manual

E. L. Crow, F. A. Davis and M. W. Maxfield; (Dover Publications, Inc.) McClelland & Stewart, Toronto; 288 pp; $1.55

These two books on statistics serve different but complementary purposes. Both are intended for the engineer or scientist who wishes to use statistical methods effectively. The first is an introduction to the subject intended as a text for a brief college course. It uses only elementary calculus to develop the background statistical theory before presenting the more practical methods of analyzing and testing data. The second volume is a handbook of statistical methods that originally appeared as a U. S. Naval Ordnance publication. It is intended for the user of statistics who must plan experiments, reduce the observations and estimate the significance of the results. The reader needs only a very general mathematical background as the manual is written for the non-expert user rather than the qualified statistician.

The authors of "Introduction to Probability and Statistics" begin by laying a careful foundation of probability models. In the first chapters, the ideas of combinations of events and the binomial law are extended to random variables and to probability and distribution functions. The important characteristics of discrete and continuous distributions follow with the standard special cases of each. The remainder of the book is concerned with the application of statistics to the treatment of data, beginning with the description of observations and the testing of hypotheses. The confidence held in estimates of the mean and variance of a distribution is used in testing hypotheses about these quantities. The closing chapters give comparison tests and a brief mention of regression and analysis of variance methods. The appendix contains eleven pages of tables and answers to the numerous problems throughout the text.

This book provides a sound introduction to statistics because the presentation of the fundamentals of probability theory before the applications to experimental data, gives a deeper understanding of statistical methods. The text is particularly lucid and extensive use is made of worked-out examples.

The authors of "Statistics Manual" assume an introductory knowledge of the subject and confine their general explanatory material to the first chapter on definitions and distributions. This book is a compendium of statistical tests and methods, and is intended to be referred to as the need arises rather than read as a text. The tests are grouped into tests on means and between means, tests on variances for comparisons and for homogeneity, and tests on whole distributions for goodness of fit and consistency. The second half of the manual deals with methods. These include experimental design, analysis of variance, factor analysis, and curve fitting by regression methods. Plans for using quality control charts and acceptance sampling procedures conclude the main body of the text. An appendix of fifty pages carries 21 tables and 11 charts useful in applications.

This book is well organized for its purpose. The text is concise, yet care is taken in each section to include the assumptions and conditions of applicability, a short statement of theory, the method of calculation and at least one example. This manual should enable scientists and engineers to properly employ modern statistical methods in the planning and analysis of experiments.

Reviewed by: H. C. Ratz, Assistant Professor of Electrical Engineering, Computer and Control Systems Laboratory, University of Saskatchewan.

IRE News—continued

nights also involve a little travelling with students from Royal Military College and Queen's University visiting Ottawa.

Toronto Section doubled its turnout at meetings by moving the time ahead to 7.00 p.m. There is an "open" dinner at the University of Toronto (lots of room and no reservations) ahead of meetings which attracts many members right from work.

Vancouver Section did a bit of travelling last year. A charter flight took members to Penticton one Saturday to see the new radio telescope.

Regina Section suffers the problem common to many sections in Canada. With little electronics industry in the area, their membership is limited. Study groups, technical films and tapes are being explored as a substitute for speakers.

Winnipeg Section tried using film last year for student meetings, but the experiment was not successful. Winnipeg, like Regina, has little electronics industry, with the result that membership in the Section has a high percentage of associate grade.

Southern Alberta must hold the all-time record for attendance. A joint meeting with the Society of Geologists and Exploring Geophysicists to hear a paper on the work of the University of Saskatchewan on Aurora, drew 2,500 people.

Section meetings

Kitchener - Waterloo: March 20; "Nuclear reactor instrumentation," by C. G. Lennox, Atomic Energy of Canada Ltd.; University of Waterloo Chemistry Bldg., 8.15 p.m.; joint meeting with Electrical Engineering Dept., University of Waterloo.

Ottawa: April 6; "Frequency standards," by Mr. Martin Block; NRC Auditorium, Sussex Dr.; 8.15 p.m.

Toronto: March 13; Annual Stag Night, at Four Winds dining room, Steeles Ave. West. Slides and talk on "A civilian's life in Thule, Greenland," will be given by B. E. Davies, Canadian Westinghouse Co. Ltd.

April 3; Meeting is being arranged by Toronto Chapter of Professional Group on Communications Systems; Hart House; 7 p.m.

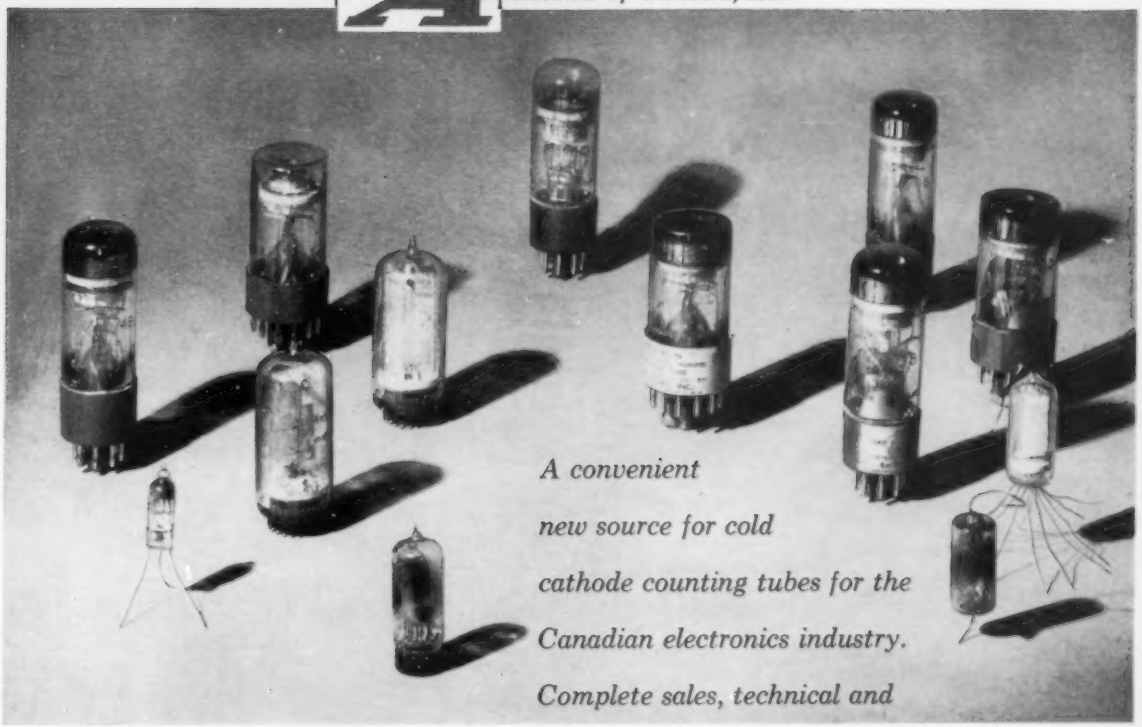
Montreal section to hold symposium

The Montreal Section of the Institute of Radio Engineers has announced that it will hold another symposium in 1962. It will be similar to the type of symposium held there last Fall. Arrangements are being made to reserve space at the Queen Elizabeth Hotel for technical sessions and exhibits for November 16-17, 1962.

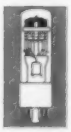
Further details may be obtained by writing to the IRE, Montreal Section, P.O. Box 802, Station B, Montreal.

Announcing . . .

Baird Atomic *of Canada, Ltd.*



A convenient new source for cold cathode counting tubes for the Canadian electronics industry. Complete sales, technical and warehousing services.



Dekatron Tubes

Full line of nine types for totalizing, sorting, programming or controlling. High speed (up to 20,000 cps). Reliable up to 100,000 hours.

Sign Digitron

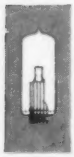
Registers the arithmetical operation being followed during random add-subtract counting operations.

Fraction Digitron

Direct readout of the state of count of a ring of four cold-cathode or thermionic tubes. Display: ¼, ½, ¾ and 1.

Miniature Digitron

Ten digit direct readout suitable for miniature remote readout systems. Simple, compact, long life.



Tetrode Trigger Tube

Designed for Dekatron coupling and readout circuits. Reliable in self-quench circuits. Drift-free operation.

Computer Trigger Tube

Inexpensive sub-miniature tubes especially designed for computer application. Widely used for slow-speed storage applications.

Voltage Reference Tube

Useful in high-level stages of DC amplifiers. No jump in characteristic. Constant internal resistance.

Write for handbook with valuable information on applications, circuitry and specifications.

Price $1.00

Full Size Digitron

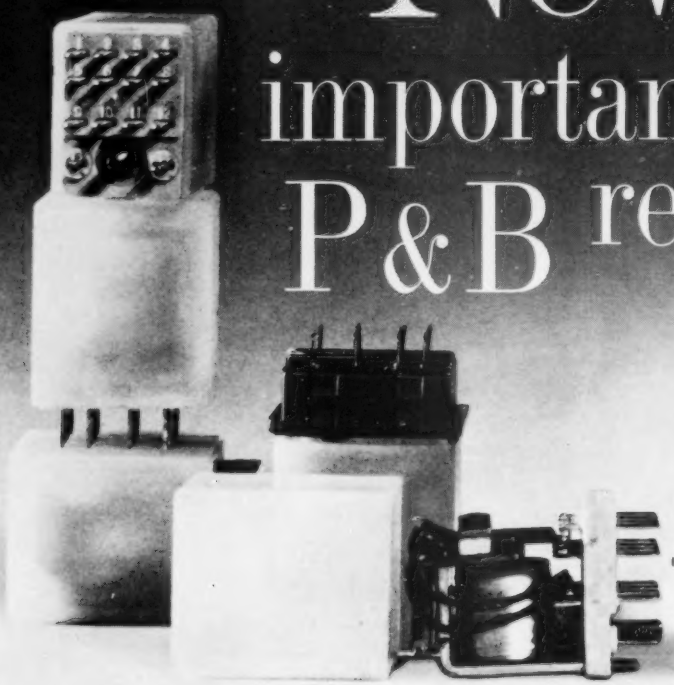
Indicates digits 0 through 9. Ideal for remote readout and indicator panel applications.

BAIRD-ATOMIC *of Canada, Ltd.*

Suite 303, 465 Gilmour Street, Ottawa, Ontario

For further information mark No. 17 on Readers' Service Card

a New and important P&B relay . . .

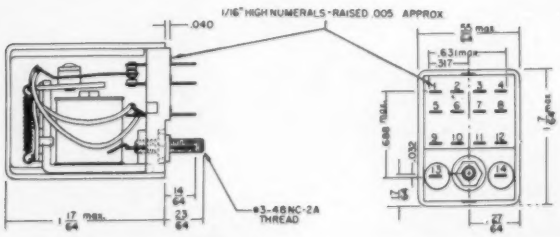


KHP SERIES SHOWN ACTUAL SIZE

having rare longevity

This small, 4-pole relay has the happy faculty of maintaining its original operating tolerances over an exceptionally long life. Example: tests (by customers!) show this relay has variations in electrical characteristics of less than 5% after more than 100 million operations.

But that's far from all. This is a *small* relay . . . about a one inch cube. This relay is easy to install using the conveniently spaced solder lugs or a socket. Thus you save time and production costs. This relay is versatile . . . its 4PDT contacts will switch loads from dry circuit up to 3 amperes. This relay—well, why not order samples and see for yourself! Order today from your P&B representative or call us at Fulton 5-5251, in Princeton, Indiana.



KHP SERIES SPECIFICATIONS

CONTACTS:

Arrangement: 4 Form C, 2 Form Z.

Material: 3/32" dia. Silver standard. Silver cadmium oxide and gold alloy available.

Rating: 3 amps @ 30 volts DC or 115 volts AC resistive for 100,000 operations.

COILS:

Resistance: 11,000 ohms max.

Temperature: Operating Ambient: —45°C. to +70°C.

Power: 0.5 watts min operate @ 25°C. 0.9 watts nom. @ 25°C. 2.0 watts max. @ 25°C.

TIMING VALUES:

Nominal Voltage @ 25°C.	Max. Values
Pull-in time	15 ms
Drop-out time	5 ms

INSULATION RESISTANCE: 1500 megohms min.

DIELECTRIC STRENGTH:
500 Volts RMS 60 cycles between contacts.
1000 Volts RMS 60 cycles between other elements.

MECH. LIFE: In excess of 100 million cycles.

SOCKET: Solder lug or printed circuit terminals. Available as accessory.

DUST COVER: Standard.

TERMINALS: Solder lug and taper tab.

P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONIC PARTS DISTRIBUTOR

POTTER & BRUMFIELD

DIVISION OF AMF CANADA LIMITED • OXFORD STREET, GUELPH, ONTARIO

YOU CAN GET "RIGHT NOW" DELIVERY

of standard P&B relays from these leading electronics distributors

ALBERTA
CALGARY
Canadian Electronics Ltd., 334-336 4th Ave. S.E.
Sacker Electronics Co., Ltd., 509 16th Ave. N.W.
Smalley's Radio Ltd., 1105 7th Ave., W.
EDMONTON
Canadian Electronics Ltd., 109 St. at 107 Ave.
Sacker Electronics Co., Ltd., 10235 103rd St.
Taylor, Pearson & Carson Ltd., 10215 103rd St.

BRITISH COLUMBIA
NANAIMO
Ellison Queale Radio Supply
VANCOUVER
Robinson Electric Co. Ltd., 1179 Homer St.
Taylor, Pearson & Carson Ltd., 1006 Richards St.
L. A. Varah Ltd., 1451 Hornby St.
Western Agencies Ltd., 951 Seymour St.
VICTORIA
Ellison Queale Radio Supply, 900 View St.

MANITOBA
WINNIPEG
Cam Gard Supply Ltd., 397 William Ave.
Del's Electric Motor Supply, 54 Princess St.
Electrical Supplies Limited, 306 Ross Ave.
Lee Bern & Company Ltd., 341 William Ave.
United Refrigeration Parts, 223 Garry St.

NOVA SCOTIA
HALIFAX
Consolidated Supply Company Ltd.

ONTARIO
CHATHAM
Industrial Components (Central Ontario) Ltd.
161 Richmond Street
DOWNSVIEW
Alpha Aracon Radio Co. Ltd., 555 Wilson Avenue
FORT WILLIAM
Inter-Comm Supply Company Ltd., 1315 Victoria Ave.
HAMILTON
The Crawford Radio, 119 John St. N.
Western Radio Supply Co. Ltd.
182 Rebecca St., (at Ferguson)
KITCHENER
MacDonald Electric Limited, 307 Queen Street, S.
LONDON
Industrial Components (Central Ontario) Ltd.
649 Colborne Street
NORTH BAY
Johnson Electric Supply Ltd., 135 McIntyre Street, E.
OSHAWA
H. W. Gourley Ltd., 311 Viola Avenue
OTTAWA
Wackid Radio Television Laboratories Ltd.
149 Gloucester St.
PORT ARTHUR
Inter-Comm Supply Company Ltd., 211 Pearl Street
ST. CATHARINES
Niagara Vallance, Brown, 23 Permilla Street
SARNIA
Industrial Components (Central Ontario) Ltd.
240 Maxwell Street
TORONTO
Canadian Electrical Supply Co. Ltd., 877 Yonge Street
Electro Sonic Supply Co. Ltd., 543 Yonge St.
Shipman Electronics, 1773 Avenue Road
Wholesale Radio & Electronics Ltd., 66 Orfus Road
WATERLOO
Waterloo Electronics Supply Co., 219 Hartwood Ave.
WINDSOR
Electrozad Supply Co., Ltd., 38-42 Shepherd St., E.
Industrial Components (Central Ontario) Ltd.
600 Wyandotte Street, E.

QUEBEC
MONTREAL
Atlas Wholesale Radio Inc., 4985 Buchan St.
Payette Radio Ltd., 730 St. James St. W.
QUEBEC
Crobel Ltd., 790 Boulevard Charest East

SASKATCHEWAN
REGINA
Radio Supply & Service Ltd., 1965 McIntyre St.
SASKATOON
Radio Supply Company Ltd., 561 2nd Ave. N.

P&B REPRESENTATIVES
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A.T.R. Armstrong Ltd., 700 Weston Road, TORONTO 9, Ontario
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For further information mark No. 59

CAMESA News

This bulletin has been prepared for CEE by the Specifications and Electron Devices Divisions, Canadian Military Electronics Standards Agency, Ottawa.

▸ Military Standard **MIL-STD-710,** covering the use of synchros in military electronic equipment, has been issued recently. This standard is to be used in conjunction with Specification MIL-20708A, and its associated detail specification. It is intended to standardize the types of synchros used in military equipment. Where a designer finds it necessary to develop a new synchro, or to use a type not covered by MIL-STD-710, approval of the procuring activity must be obtained.

▸ Specification **MIL-C-15305B,** covering radio frequency coils and intermediate and radio frequency transformers, has been issued recently. Modifications appearing in this specification are the addition of tests and requirements for self-resonant frequency, barometric pressure and winding continuity. Inspection conditions covering control of frequency and voltage, and permitting demagnetization have been added. Group "C" inspection has also been added.

▸ Specification **MIL-C-8384B,** covering molded-body electrical connectors of the plug and receptacle type, has been issued recently. This specification is now in the form of a general specification, and it is expected that detail specifications for individual connectors will be added at a later date. The temperature cycling, moisture resistance and vibration tests are now to be in accordance with Military Standard MIL-STD-202. The contact life requirement has been increased from 200 to 500 cycles of insertion and withdrawal. An impact resistance test has been added on a "when specified" basis.

▸ Specification **MIL-R-5757D,** covering relays other than thermally operated, has been issued recently, together with seven detail specifications. This document supersedes specifications MIL-R-5757C, MIL-R-21093A (Ships) and MIL-R-25018(USAF) as well as Canadian Specification Sheets CSS-95 and CSS-97A. A large number of modifications appear in Specification MIL-R-5757D.

Silicon power diodes

▸ The following plan for the standardization of silicon power diodes has recently been adopted:

Current ranges: 150, 250, 500 ma; 1, 5, 12, 20, 35, 50, 70 amps. As production increases it is expected that the price differential between adjacent ranges will be reduced, and it is possible that the number of current ranges will be reduced accordingly. The most likely ones to be dropped will be the 5, 20, and 50-amp ranges, which will then be covered by the 12, 35, and 70-amp ranges respectively.

Voltage ranges: 200, 400, 600, 800, 1,000v where units with these ratings are available. At present only one diode in each of the 800 and 1,000v ranges is recommended. At the higher current ranges 100 and 300v diodes are also recommended because of the large price differential between adjacent ranges.

▸ The currently recommended types are shown in the table. These types have been recommended for inclusion in the next issue of MIL-STD-701, and will probably be included in the next Preferred and Guidance List of Semiconductor Devices to be issued by CAMESA, later this year.

▸ While no plan of standardization has yet been agreed for High Voltage Diodes and Silicon Controlled Rectifiers, certain types are nevertheless being recommended for military use. Details of these types can be obtained upon request from CAMESA.

▸ Specification **MIL-W-287B,** Waveguide Assemblies, Flexible (as mentioned in the November 1960 issue), has now been issued.

Volts	150 ma	250 ma	500 ma	1 amp	5 amp	12 amp	20 amp	35 amp	50 amp	70 amp
100							1N249B	1N1184	1N2173	1N1307
200	1N645	1N538	1N3189	1N1124A	1N1614	1N1202	1N250B	1N1186	1N2174	1N1399
300							1N2135A		1N1682	
400	1N647	1N540	1N3190	1N1126A	1N1615	1N1204		1N1188		1N1401
600	1N649	1N547	1N3191	1N1128A	1N1616	1N1206		1N1190		1N1403
800		1N560								
1000		1N561								

The Ampex FR-700 wideband magnetic tape system can function as a universal predetection telemetry recorder. This ground-based companion to the airborne AR-300 both records and reproduces, and will play back tapes recorded on any Ampex AR-300. Bandwidth data is FM recorded using a 6 megacycle carrier. Rotating magnetic heads record transversely, one wideband channel for one hour at 12½ ips., or two wideband channels simultaneously for one-half hour at 25 ips. Input power is 1200 watts at 50 or 60 cycles. For specifications write to Ampex of Canada, Ltd., 607 Commonwealth Bldg., Ottawa, Ontario. AMPEX

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Science Fairs

The Science Fair movement is gaining momentum in Canada. This year, more exhibitions than ever before will be held in a number of communities.

A Science Fair is an annual exhibition of secondary school students' scientific projects, experiments or collections. A project may show original research or be a demonstration of a biological, chemical, physical, mathematic or technical principle, a laboratory or other procedure, an industrial development or an orderly collection of anything in the broad concept of pure or applied science.

The majority of Science Fairs in Canada are sponsored by educational, service, industrial or professional groups. Their purpose is to promote an interest among students below the secondary school graduation level, and to provide a place for these students to display their ability. Science Fairs stress imagination and creative ability, rather than craftsmanship.

At least one fair has been held already at Sarnia Collegiate Institute and Technical School. It was sponsored by the Sarnia Section of the Chemical Institute of Canada, February 20.

Other fairs scheduled for early spring are:

Kingston, Ont.: sponsored by the Kingston Sections of The Chemical Institute of Canada and the Engineering Institute of Canada: March 17-18.

Vancouver: sponsored by the Vancouver Section of The Chemical Institute of Canada and the Y's Men's Club.

Toronto: 1961 Ontario Science Fair, held at the Queen Elizabeth Building, Toronto; sponsored by the Rotary Club of Swansea in association with The Telegram: April 5-7.

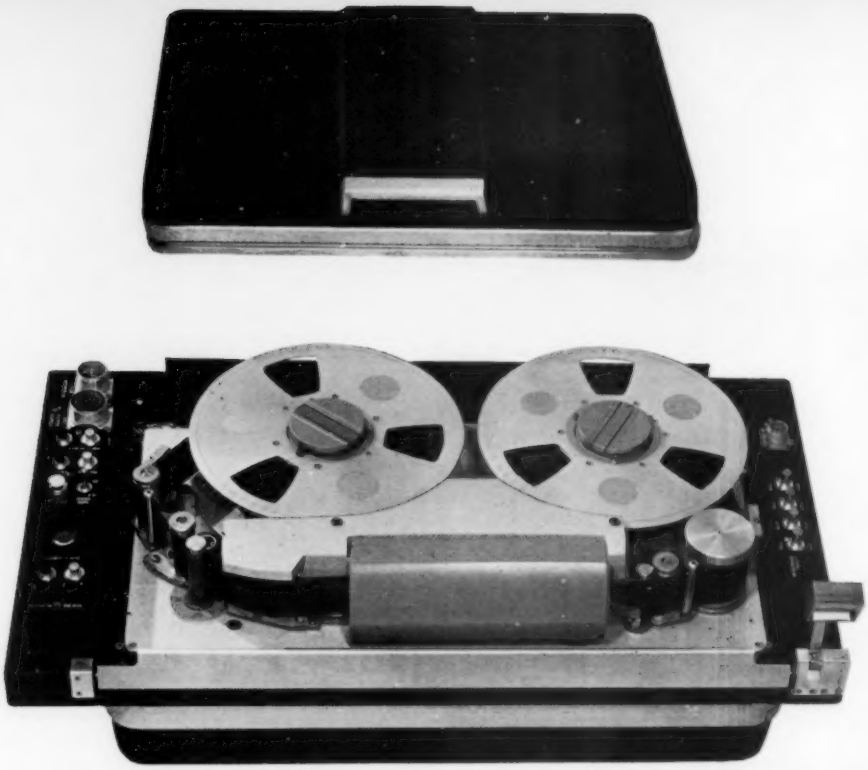
Winnipeg: sponsored by the Winnipeg Rotary Club: April 6-7.

Montreal: Montreal Metropolitan Science Fair: sponsored by the Montreal Sections of The Chemical Institute of Canada and the Engineering Institute of Canada: April 7-8.

A number of other communities have been considering holding Science Fairs, but information has not been received about definite plans from any of them. No doubt there will be an increase in the number of fairs held in 1962 as other people learn about the value to the students and the community generally.

Anyone wishing guidance in establishing a local Science Fair should write to the Canadian Science Fairs Council, 48 Rideau St., Ottawa. The Council is sponsored by a group of educational and scientific associations.

"Only thing I can figure is that the boys in assembly took this jiggly line for a resistor . . ."



The Ampex AR-300 airborne magnetic tape recorder
offers 16 times the frequency response of existing wideband equipment. New applications in video bandwidth recording such as radar tracking and reconnaissance, simulation and wideband communications monitoring, are now practical because the AR-300—and its ground-based companion, the FR-700—employs rotating magnetic heads...a principle pioneered by Ampex and now in use by more than 650 VIDEOTAPE* Television Recorders throughout the world. Two channels of wideband information can be captured over a data spectrum from 10 cps to four megacycles, ±3 db. Simultaneously, two auxiliary information channels, with frequency response from 200 cps to 15 Kc, are recorded linearly along the edge of the tape. Solid-state components and advanced packaging techniques case-shock mounted provide a recording system that displaces only 3½ cu. ft., weighs less than 150 lbs. To obtain a highly accurate time-base relationship, tape is pre-heated prior to recording. A heat exchanger maintains constant ambient, insuring reliable operation of the AR-300 under extreme environmental conditions. For specifications write to Ampex of Canada, Ltd., 607 Commonwealth Bldg., Ottawa, Ontario. AMPEX

*TM AMPEX CORP

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People — continued

O. W. Rodomar, former president of Philips Industries Ltd., died at the age of 60 in Toronto, January 30.

Mr. Rodomar was associated with Philips Industries from 1947 as general sales manager, vice-president, and director. In 1953 he was elected director and vice-president of Rogers Majestic Radio Corporation Ltd., and in 1955, became a director of Philips Electronics Industries Ltd.

President of Philips Industries since 1956, he stepped down when taken ill one year ago, and was, until his death, vice-president in charge of public relations of Philips Electronics Industries.

T. C. Arnold has been appointed zone sales manager for Onan products in Canada; J. A. Fellows heads Onan division of Burlec Sales.

Mr. Arnold will be responsible for sales of all products of the Onan Division of Studebaker-Packard Corp. in all provinces except Alberta and B. C. He has BASc and MComm degrees from U of T, and an MBA from the University of Western Ontario. His background includes ten years of diversified experience in manufacturing, engineering and sales in the electrical and associated industries. His office is in Montreal.

Burlec Sales have recently acquired the central Ontario franchise for Onan generating equipment and have set up a new division to handle this product line. Mr. Fellows entered the sales field as manager of the Industrial Division of Canadian Aviation Electronics Ltd., then moved to Pye Canada Ltd. as manager of its Telephone Division. His most recent position was as sales manager for Tele-Radio Systems Ltd.

F. A. Stanley is elected director of the de Havilland Aircraft of Canada Ltd.

Mr. Stanley is a graduate of the University of Toronto, and joined de Havilland in 1954 as comptroller, a position he will retain in addition to his new duties as a director.

J. McKerrow, manager of General Instrument Ltd., Semiconductor Div. adds S. R. Mester and C. A. Pipe to sales staff.

With production of semiconductors now under way at their Waterloo, Ont., plant, John McKerrow, manager of the Semiconductor Division of General Instrument Ltd. has announced the appointment of two members to his sales staff. Sol R. Mester, P.Eng., becomes sales manager for semiconductor and thermoelectric products, covering Montreal, Ottawa and Eastern Canada; Cliff A. Pipe becomes semiconductor sales representative for Ontario.

McKerrow

Mester

Pipe

Barry

Honeywell Controls Ltd. has appointed Bruce J. Barry as branch manager at London, Ont.

Mr. Barry joined Honeywell in 1946 as supervisor of the Industrial Division order department, and since 1954 has been a member of the General Region sales force.

BRUEL & KJAER

Precision

SOUND LEVEL METER

TYPE 2203

This compact battery-operated *Bruel & Kjaer* Sound Level Meter is a *high-precision, portable instrument* specifically designed for quick accurate measurement of traffic noise, and noise in factories and buildings. It gives *direct scale reading in db* sound level. Measuring range is 22 db to 134 db . . . and accuracy is within 1 db.

This instrument can be connected to external 1/1 or 1/3 octave filters *which converts it into a Frequency Analyzer*. By connecting the output to a Level Recorder a paper-recorded reading can be made.

A linear frequency range of 20 c/s to 20,000 c/s is also included which facilitates the use of the instrument as a sound level meter and as a battery-operated preamplifier for voltage and vibration measurements.

This Bruel & Kjaer Sound Level Meter is transistorized for low power consumption and is equipped with a precision condenser microphone.

For complete information and demonstration write or call —

R-O-R ASSOCIATES LIMITED

1470 DON MILLS RD., DON MILLS, ONT.

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W. Roy Ellis has joined The Indiana Steel Products Co. of Canada Ltd, as a sales engineer.

Mr. Ellis will be responsible for the sale of stainless steel, permanent magnets, ferrites, memory products and whiteware. His territory will cover Quebec, New Brunswick, Nova Scotia, P.E.I., and northeast Ontario; his office is at 685 - 38th Ave., Lachine, Que.

W. Ross Woodrow has been elected president of the Canadian Business Equipment Manufacturers Association, Inc.

Other offices of the 50-member association include **J. A. Stewart,** vice-president, and **A. O. Dawson,** secretary-treasurer.

Warren H. Chase nominated as 1961-62 president of the American Institute of Electrical Engineers.

Mr. Chase, a Harvard B.Sc., is vice-president of the Ohio Bell Telephone Company, and his nomination with those of ten vice-presidents and four directors were announced at the winter general meeting.

Election is by mail ballot and results will be announced at the summer general meeting in June.

Reports — continued

Canadian companies open new offices

A new branch of **Western Agencies Ltd.,** Vancouver, B.C. has been opened at 409 Third Ave., Prince George, B.C. **Herb Ellams** has been appointed manager. The president of Western Agencies, Arnot M. Clark, is also president of the Canadian Electronic Wholesalers' Association.

Garrett Mfg. Ltd., Toronto has established an Ottawa office at 75 Albert St., under the direction of **Bruce D. Darling.** Telephone is CEntral 6-0441.

Mark J. Weber has been appointed district sales engineer of **Electronic Research & Development Co.,** Division of Mandrel Industries Ltd., Calgary, and will manage the company's newly opened office at 381 Tillbury Ave., Ottawa — telephone PArkway 2-4353. During the past four years, Mr. Weber has held a similar position in the firm's Edmonton office.

From his new post, he will be responsible for marketing ERD-Du Mont products in Ontario and Quebec.

Desser E-E Ltd., Montreal, has moved its Ontario sales office to 77 York St., Toronto—telephone EMpire 6-1825 (see CEE, Dec. 1960, p. 54). William A. Wilson is no longer a representative of the firm.

Whittaker Electronics Ltd., Ottawa, has opened a new office at 2 Neapolitan Dr., Scarborough, Ont. under their new Central Ontario manager, **Mr. Al Ingram.** Telephone number is AXminster 3-3161. Stocks will be maintained of the products of Spectrol, Gudebrod, Dressen-Barnes and International Instruments.

New company changes name

Pyrel Ltd., manufacturers' representatives (see CEE, Nov. 1960, p. 54), has changed its name to **Canoy Components Ltd.** Offices remain at 12 Duchess St., Toronto 2.

Firms make licensing agreements

Centralab Canada Ltd., Ajax, Ont. have taken over the manufacture of **Methode sockets** in Canada from

(Continued on page 68)

MALLORY

Voltage reference mercury battery

APPLICATIONS . . .

- Calibration of Oscilloscopes
- Direct Calibration of volt — OHM meters and vacuum tube voltmeters
- Temperature measuring bridge
- Grid Bias
- Direct Measurement of Unknown DC Voltage

PERFORMANCE FEATURES

Shock — The battery will stand high impact with no change in EMF.
Vibrations — Vibration will not modulate the EMF.
Position — The battery will operate in any position.
Short Circuits — Accidental intermittent short circuits for brief periods, from several seconds to several minutes, will not damage this reference battery.
Load Currents — The EMF is not destroyed after sustained loads are applied within the capacity of the cell.
Temperature and Regulation — For a continuous current up to 100 microamperes, the EMF will stay within a 1% overall tolerance from —20°F to 160°F.
Storage — at —20°F to 80°F. For best storage conditions, it is desired that an average temperature of 70°F be maintained.

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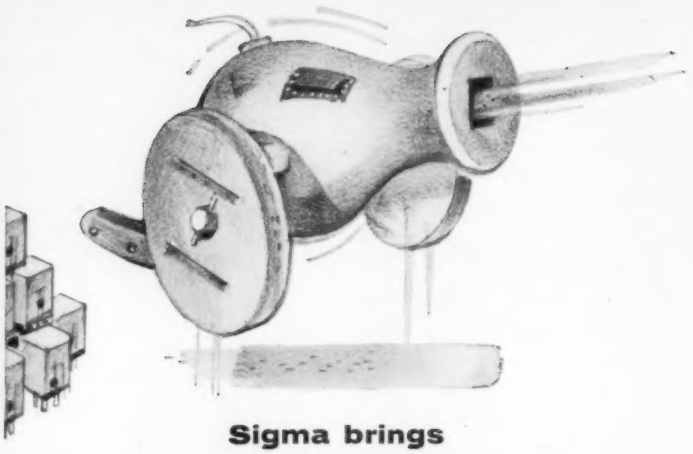


Sigma brings big gun to bear on commercial relay field

There's a new Sigma relay just coming into the picture that's so disarmingly simple in design, construction and operation that Believers in Complexity will probably get mad when they see it. (After all, if you give someone a simple answer to anything nowadays they think that you couldn't possibly have understood the problem.) But the reaction around here is that the designer's really got something, and there was even talk about erecting a small monument to him in the parking lot.*

We were going to call this new general purpose AC-DC relay the "Series 90" until there was some rumbling in the number department, so now it has the much more economical, sensibly conservative number of 46. It's an honest-to-goodness *good* heavy duty commercial relay, that will switch up to 10 amp, 120-volt resistive loads on as little as 200 mw. DC or 0.5 v-a AC. What the big simplicity pitch Means To You is that there are so few parts it's almost impossible for anything to get out of whack; the few parts it *does* have aren't hard to make or assemble (translated, $3 or $4 per relay in quantity); a big motor and fat DPDT contacts efficiently use every bit of the volume and give a long mechanical life — from 500,000 operations on 10 amp loads to 10 million operations at no load. Since we hope the "46" will find its way into such things as machine tool controls, timers and laundry equipment (and even smarter Electronic Devices as well), the octal plug-in base has the same pin connections as the relays already sitting in this type of equipment. If you want to call this a retrofit, go right ahead. That's it there in the picture, in a revealing 1 5/16" x 1 5/16" x 2 1/16" plastic enclosure.

The first few thousand are now beginning to roll, and while we're not quite ready to talk delivery by the carload, anyone interested in trying out 46's in sample quantities will get to sit in the sales manager's padded office for 8½ glorious minutes.

*We decided not to overdo it and gave him a Rolls-Royce instead.

Series 46 Relays and other selected Sigma products and personnel on display at booths 2628-2630, New York Coliseum, March 20 to 23. Come energize them.

SIGMA

SIGMA INSTRUMENTS, INC.
34 Pearl Street, So. Braintree 85, Mass.

For further information mark No. 67 on Readers' Service Card

Reports—continued

Methode Mfg. Canada Ltd., Hanover, Ont. In addition, Centralab has been appointed Canadian sales representative for U. S.-manufactured items such as connectors, printed wiring boards, Ply-O-Duct, etc.

Seabreeze Mfg. Ltd. are to manufacture in their Toronto plant the full line of **Motorola consumer products,** including table, clock and AM/FM radios; stereo and high-fidelity units; television receivers; car radios. These products will be sold through independent regional distributors by J. O'Brien Industries Ltd., Toronto.

CAE adds third subsidiary

A new subsidiary company, C.A.E. Electronics GmbH, has been formed in West Germany to carry out maintenance work on F-104 flight simulators being manufactured in Montreal by Canadian Aviation Electronics Ltd. for the governments of Canada, Germany, Holland and Belgium.

The new company will have its headquarters initially in Bad Godesberg. It brings to three the number of subsidiary companies formed by CAE during the last twelve months. The other two are Oneida Electronics Inc. in Utica, N.Y. and Calmont Industries Inc. in Los Angeles.

Ottawa report — cont.

also commented that it is expected that employers will place increasing emphasis on the quality of their science and engineering recruits.

The Committee said: "Forecasts for 1960 to 1963 . . . indicate a continued need for engineering and scientific personnel. There might even be some shortages in the last year or two of this period depending on the supply of graduates, immigration and other factors."

And it added: "The supply of engineers will probably remain relatively stable during this period, with the main source being Canadian university graduates. Immigration has dropped and will likely remain quite low, so that it cannot be relied upon in the foreseeable future as a cushion for imbalances in demand and supply of engineering and scientific manpower."

The committee concluded that the highest rates of employment expansion over the next three years would be in the metallurgical, mechanical, civil and chemical fields. It forecasts a leveling in electrical engineering and slower gains in mining engineering.

Defence contracts

Unclassified electronics contracts for $10,000 or more have been awarded to the following Canadian firms by the Department of Defence Production. A figure in parentheses indicates the number of contracts, the amount being the total value.

January 1-15, 1961

- Ahearn & Soper Co. Ltd., Ottawa, tubes, $10,010.
- Anton Electronic Laboratories Inc., Ajax, Ont., radiacmeters, $19,536.
- Canadair Ltd., Montreal, aircraft systems trainers, $300,000.
- Canadian Applied Research Ltd., Toronto, components, $12,090.
- Canadian General Electric Co. Ltd., Toronto, radar spares, $15,789.
- Canadian Westinghouse Co. Ltd., Ottawa, tubes, $39,684.
- De Havilland Aircraft of Canada Ltd., Downsview, Ont., design, development and installation of electronic equipment, $23,060.
- Lake Engineering Co. Ltd., Scarborough, Ont., tubes, $11,895.
- Litton Systems (Canada) Ltd., Toronto, spare parts for aircraft navigation systems, $931,783.
- Northern Electric Co. Ltd., Ottawa, spares for teletype equipment, $22,991.
- Northern Radio Mfg. Co. Ltd., Ottawa, multiplex telegraph equipment, $21,879.
- Sylvania Electric (Canada) Ltd., Montreal, transformers, $17,389.

January 16-31, 1961

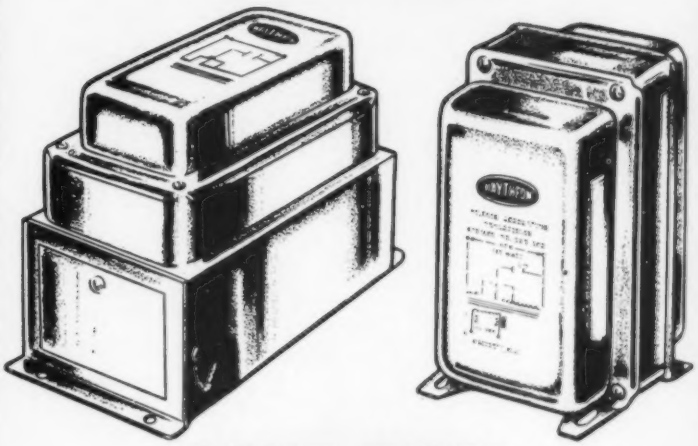
- Ampex of Canada Ltd., Ottawa, magnetic tape, $15,451.
- Canadian Applied Research Ltd., Toronto, ground speed interception computers, $201,101.
- Canadian Marconi Co., Montreal, reproducible drawings, $13,553; airborne receivers, $1,491,568 (2).
- Canadian Marconi Co., Toronto, tubes, $94,840.
- Canadian Motorola Electronics Ltd., Toronto, components, $35,440.
- Collins Radio Co. of Canada Ltd., Toronto, navigational instruments, $21,439; technical publications, $35,676; emergency transceivers and spares, $438,175.
- De Havilland Aircraft of Canada Ltd., Downsview, Ont., satellite structures, $21,804.
- E.M.I.-Cossor Electronics Ltd., Dartmouth, N.S., telecommunication spares, $19,367.
- Northern Electric Co. Ltd., Ottawa, aircraft electrical components, $25,985.
- Philco Corp. of Canada Ltd., Don Mills, Ont., technical representatives, $77,115.
- Sparton of Canada Ltd., London, sonobuoy transmitters, $1,499,086 (2).
- Sylvania Electric (Canada) Ltd., Montreal, tubes, $54,000.
- TMC (Canada) Ltd., Ottawa, maintenance spares for torn tape relay equipment, $13,767.
- F. V. Topping Electronics Ltd., Toronto, dual frequency shift keyer exciters and spares, $47,833 (2).

RAYTHEON

MAGNETIC

VOLTAGE REGULATORS

2,020 MODELS



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YOUR CHOICE of 2,020 different *standard* models of magnetic voltage regulators, ranging from 10VA to 10,000VA.

FOUR CASE STYLES: Apparatus, Component, Open or Encapsulated.

OTHER FEATURES: Compact, rugged—no tubes or moving parts, nothing to service or replace—protected against short circuits and voltage surges—output stabilized to within ±1%—isolated secondary windings on all models.

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RAYTHEON

EXCELLENCE IN ELECTRONICS

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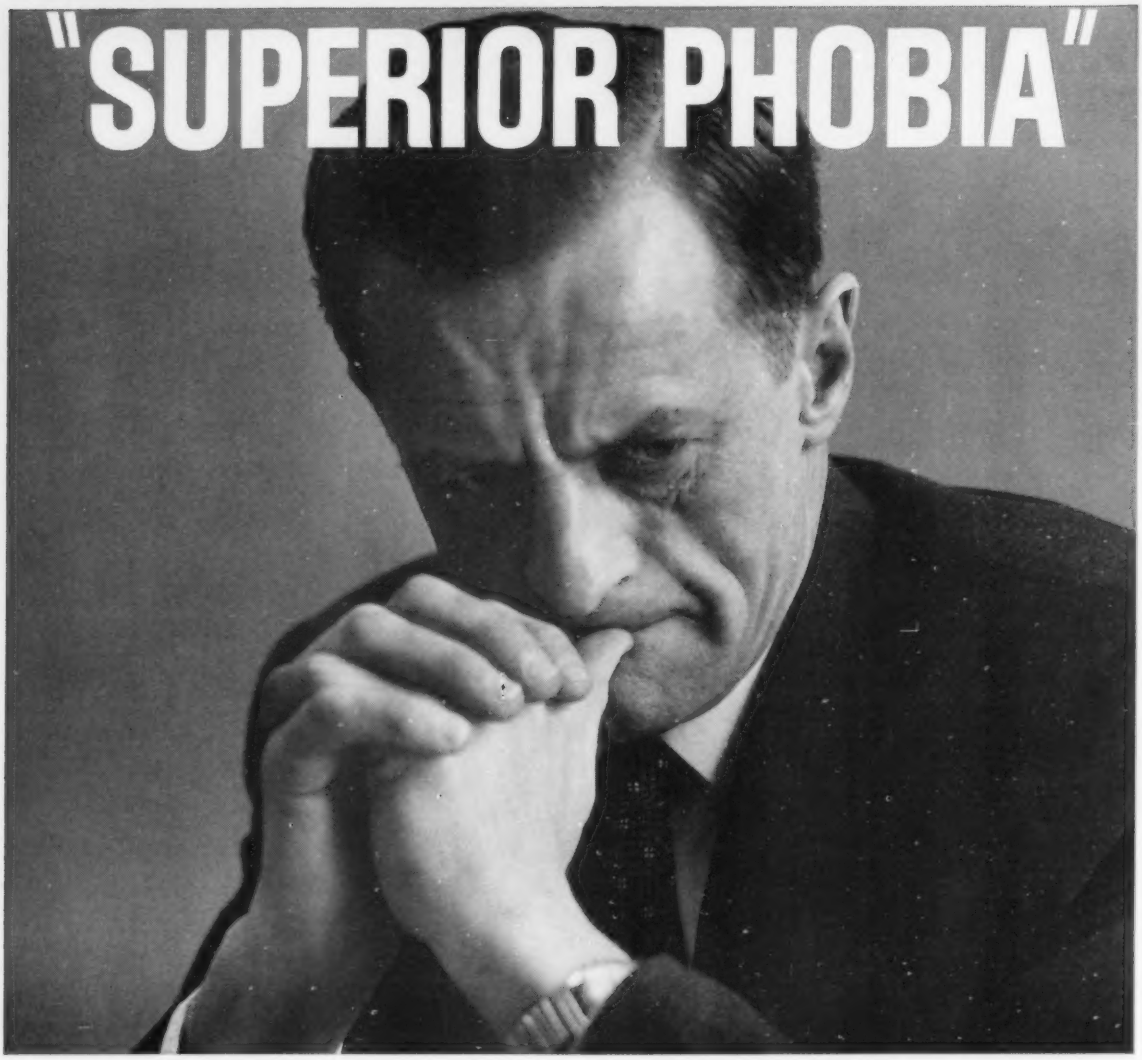
"SUPERIOR PHOBIA"



A recent experimental study, applying some techniques of motivation research to industrial purchasing, concluded that the personalities of the people involved is a major factor in the final industrial purchase decision.

The personality trait most frequently noted was "Superior Phobia," evidence of some fear of having superiors disagree with the individual's actions or opinions in the purchase decision.

It makes sense that selling is easier when everyone involved in purchasing decisions is inspired with *confidence* in your company and sure of their judgments in selecting your products.

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BUSINESS NEWSPAPERS

GET YOUR MESSAGE THROUGH CLOSED DOORS TO PEOPLE WHO SPECIFY AND BUY

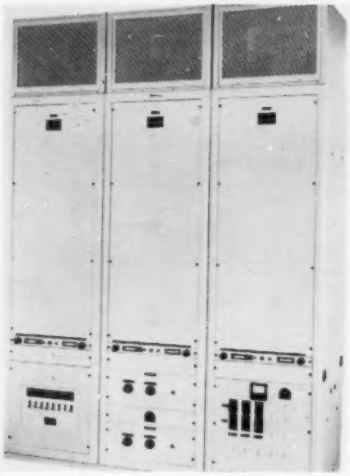
New products—cont.

Fuses 153

A comprehensive range of catridge fuses, designed in Canada, is now available to the aircraft and electronics industries. Included in the list are normal blow and timelag fuses in a selection of current, voltage and time ratings.

Electronic Components Ltd., Toronto.

High power audio amplifiers 154



Model A800 amplifier system consists of three 800-watt amplifiers with input facilities for telephone circuits and microphones. The system was designed for paging facilities in noisy locations such as generating stations. Bandpass characteristics are 400-3500 cps. with rising characteristic within the passband of 6 db per octave. Volume limiting is provided to permit higher average power output.

Barvic Engineering Ltd., Vancouver.

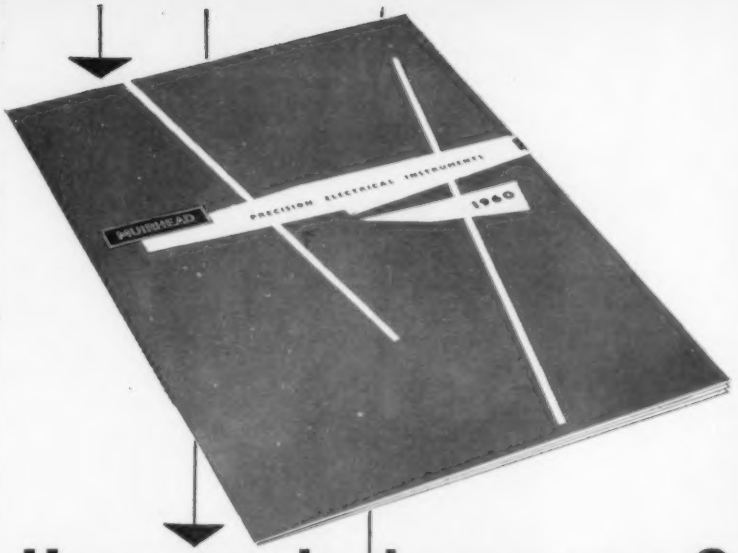
Solid state telegraph devices 155

CAE, in co-operation with Canadian Pacific Telegraphs, has developed a line of solid state telegraph equipment which has been registered under the trade name "Telepath". At the present time the line consists of: Autocall system to handle up to 15-way stations; Selector unit to provide private wire-party line service to operate teleprinters on any terminal equipment at speeds up to 6000 bands; Multiple-line regenerative repeaters made up in 5 line blocks and single line regenerative repeaters; Solid state teleprinter relays.

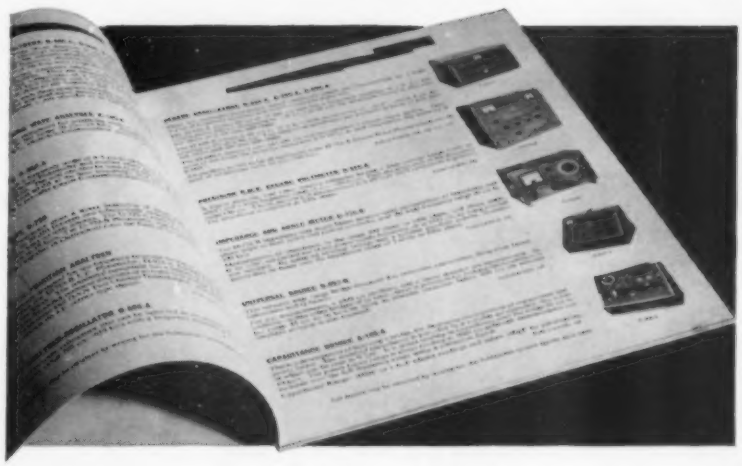
The line features a high degree of reliability, with mean time between failures of 2½ years and minimal in-service adjustments.

Canadian Aviation Electronics Ltd., Montreal.

(Continued on page 72)



Have you had your copy?



The new MUIRHEAD abridged catalogue briefly describes the latest instruments in production and quotes the reference numbers of the publications which more fully describe individual types.

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CANADA'S NUMBER ONE GENERAL-PURPOSE RESISTOR...

IRC GBT 1/2

This fixed carbon composition resistor with its handsome shiny green appearance, is unsurpassed in solderability, low operating temperature and excellent power dissipation.

NO HOT SPOTS. Exclusive IRC element is formed by depositing a carbon film of controlled thickness on special glass filament with continuous curing to prevent "HOT SPOTS".

RAPID HEAT DISSIPATION. Wire leads extend into resistance element to provide increased ability to dissipate greater heat more rapidly.

DUAL PROTECTION. Molded housing gives protection from moisture and mechanical damage and at the same time prevents any possibility of grounding.

ANCHORED LEADS. Leads withstand 5 lb. pull test even before molding. The special vanes anchored into the molding to prevent twisting.

For further information write for bulletin B 1E

IRC **RESISTORS** division of Renfrew Electric Co. Limited

TORONTO • OTTAWA • MONTREAL • CALGARY

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NOW AVAILABLE FROM STOCK

A Wide Variety of Coaxial Cables Including:

Standard and Low Temperature Jacket RG/U
Polyethylene, Polyfoam and Teflon
Dielectric Community Types.

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New products—cont.

Static voltage regulator 156

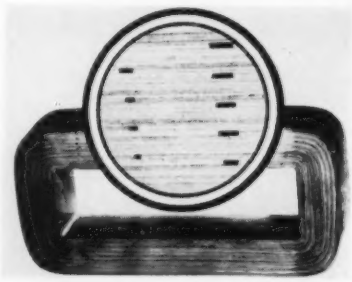
Model 532 static voltage regulator controls the output voltage of an alternator by controlling exciter field current. Solid state electronics have been used to increase reliability, reduce maintenance, reduce drift of voltage setpoint, and improve transient response of an exciter. AC input (proportional to alternator output) is 115 volts nominal, 60 cps single phase, adjustable +12 volts. Exciter field current is 2.0 amperes max.; regulator resistance limits

are 12 to 300 ohms. approximately; maximum dissipation is 45 watts continuous; ac voltage accuracy is ±1% or better; regulator time constant is 30 milliseconds.

George Kelk Ltd., Toronto.

Distributed gap wound cores 157

A wound core for use in transformer, saturable reactor, magnetic amplifiers, and computer applications has been designed to utilize the highest grades of grain oriented silicone steels. Since the desirable characteristics of these grain oriented steels are found only in the direction of rolling, this



core is assembled in such a way to provide a flux path over 99.9% parallel to this direction. The joint effect is minimized by allowing only one gap per layer around the periphery of the core. This is distributed and interleaved so that flux may be shunted through a number of parallel and adjacent layers of core material. The magnetic properties of the assembled core very closely approximate those of an Epstein sample or toroidal core. Typical losses at 15 kilogausses and 60 cps are 0.66 watts

per pound and 1.0 volt-amperes per pound, the effect of air gaps included. Such reduced losses permit higher gains in magnetic amplifier designs than have previously been available with bonded and cut cores. Sizes range from a fraction of a pound to 300 or more pounds per core.

El-Met-parts Ltd., Dundas, Ont.

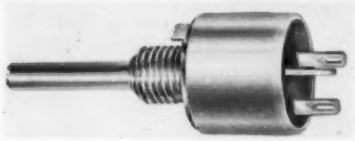
Coaxial attenuator 158

Measuring less than 2½ inches long, coaxial attenuator type AP-3 has type N fittings. Useful frequency range is dc to 2000 Mc; impedance is 50 ohms; power rating is 1 watt; attenuations available are 1, 3, 6, 10 and 20 db, attenuation accuracy is 0.1 db per db; VSWR is less than 1.2.

Pylon Electronic Development Co. Ltd., Montreal.

Miniature molded variable resistor 159

Utilizing a new hot molding technique, the resistance material of this miniature variable resistor is molded into part of the body. The ½-in. control is completely enclosed and exceeds the requirements of specification MIL-R-94B, style RV-6, for load life, rotational life, temperature cycling, vibration, shock and other operating conditions.



Another control, rated at ⅜ in. diameter and completely enclosed, has been designed specifically for printed circuit board mounting.

Precision Electronic Components (1956) Ltd., Toronto.

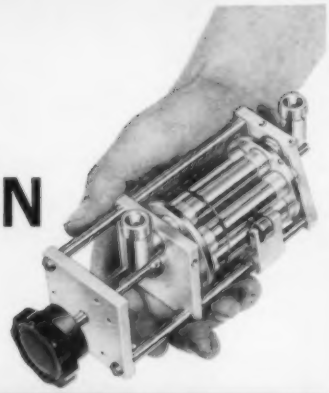
Cable fault locator 160

Model E-8630 Robinson fault locator test set has been designed for the rapid, accurate location of faults in multiconductor, shielded cable. It was designed by a team of scientists in one of Canada's major wire companies. The instrument is completely enclosed in a hardwood case, with the exception of a 6-volt storage battery.

Canadian Research Institute, Toronto.

(Continued on page 74)

CHANGE db VALUES OF ATTENUATION IN SECONDS!



STODDART'S **new** turret attenuators* offer quick change of db combinations compatible to your system requirements.

Simply remove three set screws and the pad retainer ring moves forward for easy replacement, removal or rearrangement of pads.

NET BENEFITS TO USER . . .

- Easy pad replacement eliminates downtime otherwise required for unit or equipment dismantling.
- No increase in price!

*Patent applied for

16-page UHF Attenuator Catalog No. AT-3 gives complete details and specifications of new Stoddart attenuators, terminations and turret-type step attenuators.

Represented in Canada by

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6644 Santa Monica Blvd., Hollywood 38, Calif.; Hollywood 4-9292

serving 33 countries in radio interference control

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Gives you accurate, continuously variable voltage outputs

0 to 10 v RMS, 1000 cps
0 to 10 v PEAK to PEAK, 1000 cps
0 to 10 v DC

Especially useful for checking accuracy of laboratory voltmeters and oscillographs

Ballantine's Model 420 Calibrator has proven to be an extremely useful instrument for quickly checking the calibration accuracy of voltmeters and oscillographs.

Its long term stability is such that you can rely on it for better than ¼% when using it with a calibration chart, and ½% without the chart. Accuracy checks can be made with it in less than a minute. This will help you to reduce materially the out-of-service time for voltmeters that otherwise might have to be sent to a central calibration department.

BALLANTINE MODEL 420–AC-DC CALIBRATOR

Price: $365

SPECIFICATIONS

Internal Impedance of Outputs: 2 to 20 ohms over range 0 to 10 v, 1000 cps output; less than 5000 ohms on dc output.

Distortion and Hum: Less than 0.25%.

Setting Resolution: Approaches 0.01% above 10 mv.

Power Supply: 115 v, 50-60 cps, 35 watts; 230 v, 50-60 cps on request.

Dimensions: 6" h, 6¾" w, 10⅞" d.

Write for brochure giving many more details

— Since 1932 —

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CHECK WITH BALLANTINE FIRST FOR LABORATORY AC VACUUM TUBE VOLTMETERS, REGARDLESS OF YOUR REQUIREMENTS FOR AMPLITUDE, FREQUENCY, OR WAVEFORM. WE HAVE A LARGE LINE, WITH ADDITIONS EACH YEAR. ALSO AC/DC AND DC/AC INVERTERS, CALIBRATORS, CALIBRATED WIDE BAND AF AMPLIFIER, DIRECT-READING CAPACITANCE METER, OTHER ACCESSORIES.

Represented by BAYLY ENGINEERING LTD., First St., Ajax (Toronto, Ont., Canada)

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New products—cont.

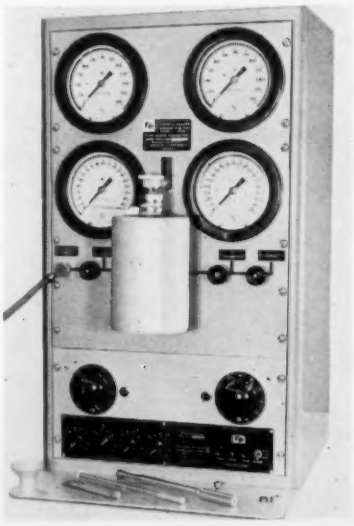
Antenna masts 161

A number of new masts and towers have been added to the Beatty line. These include both guyed masts and self supporting towers for communications and community TV antennas; heavy duty masts for carrying rhombic antennas under Arctic weather conditions; aluminum masts capable of complete assembly on the ground (originally supplied to NATO for tropospheric scatter communications); 33-in. masts for microwave, satellite TV stations and other radiators up to 500 ft.

Beatty Bros. Ltd., Fergus, Ont.

High shear viscometer 162

This instrument was originally developed by Canadian Industries Ltd. for polyethylene research work. Now manufactured under licence, model HSV-1 high shear viscometer incorporates refinements to improve ease of operation. The instrument consists basically of a heated chamber subject to precise temperature control, precision interchangeable extrusion dies, and a pressure control and measuring system operating from a compressed nitrogen bottle. The temperature controller employs a thermistor sensing element and a high gain electronic amplifier, maintaining temperature constant within a fraction of 1



deg. C at a set point variable over the range of 35 to 300 C Pressures up to 2,200 psi (maximum bottle pressure) may be used.

The material under test is extruded through the die for a known time and then weighed. Viscosity can be calculated from the test data. The viscosity range is 100 to 107 poise.

Fischer & Porter (Canada) Ltd., Toronto.

Radiation survey meter 163

This portable gamma radiation detector covers the range 0.1 to 500 r/hr. in one logarithmically calibrated scale. The detection element is a cylindrical brass ion chamber in the grid circuit of a triode-connected JCNAAF-7727 electrometer tube which drives the indicating meter. The meter is a sealed, ruggedized 3½ in. panel type meter. A three-position function switch has "Off", "On" and "Check" positions. In the

"Check" position, it connects a calibration ion chamber into the grid circuit to supply calibration current of 10-9 amperes to establish the upper check point of the logarithmic scale. There is a zero adjust also. A battery box houses the mercury cells and these may be carried inside the clothing of the operator during cold weather operation. Connection to the instrument is through a 2-ft. cable.

To date, this instrument has been produced in sample quantities only.

Canadian Admiral Corp., Ltd., Port Credit, Ont.

Insulation resistance tester 164

This line operated insulation resistance tester has test voltages of 250, 500 and 1,000 volts, all compensated for line voltage variations. Resistances up to 2,000 megohms. may be measured; the standard meter is 4-inch, but 5- and 7-inch meters are optional. The instrument can be provided as an integral part of a completely automatic test installation for production purposes, where other tests such as breakdown, continuity and leakage are required.

Canadian Research Institute, Toronto.

(Continued on page 76)

METOX

insulated power resistors

Welwyn

- **HANDLE MORE WATTS PER SIZE.** This is particularly so in the higher resistance values.
- **OFFER HIGHER RESISTANCE RANGES PER SIZE.** For example, up to 47K in the 4W F32 size.
- **ARE VIRTUALLY NON-INDUCTIVE.**
- **INSURE RELIABILITY.** Comprehensive tests have proved that operating these resistors under the most arduous conditions will not cause failure.
- **HAVE SUPERIOR SURGE AND OVERLOAD PERFORMANCE.** The application of ten times the rated load for 5 seconds results in a typical resistance change of less than 0.5%.
- **A PRICE AS COMPELLING AS THE PERFORMANCE . . .** Resulting from control and efficiency in manufacture.

UNIQUELY DIFFERENT AND RADICALLY NEW!

The Welwyn F Series power resistors are composed of a metal oxide element, bonded to a porcelain rod at red heat. This process results in a resistor which is extremely rugged, both electrically and mechanically. The durable coating is intended to provide an insulating cover rather than to protect the element which in itself is highly resistant to mechanical damage and effects of moisture.

WELWYN TYPE DESIGNATION	MAXIMUM LENGTH	POWER RATING	RANGE OF VALUES*
F32	29/32 inches	4 Watts	20 ~ to 47K
F33	1-5/16 inches	6 Watts	30 ~ to 56K
F34	1-23/32 inches	8 Watts	40 ~ to 68K
F35	2-3/32 inches	10 Watts	50 ~ to 75K

*Rated Wattage may be dissipated up to that resistance value set by a potential limitation of 500 V/inch. Where less than full Wattage is involved, potentials up to 1000 V/inch may be applied.

Welwyn Canada Limited

1255 BRYDGES ST., LONDON, ONTARIO

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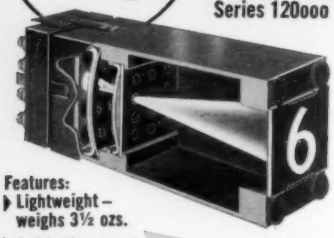
MINIATURIZED!
LIGHTWEIGHT!

IN-LINE
DIGITAL
READOUT
Series 120000



Features:
- Lightweight – weighs 3½ ozs.
- Quick disconnect at rear for easy lamp replacement.

PRICE COMPLETE
$35.00
Quantity Prices On Request
WRITE TODAY FOR COMPLETE SPECIFICATIONS
Representatives in principal cities

Over 1000 firms throughout the world in just a few years prove unprecedented acceptance of IEE digital readouts.

INDUSTRIAL ELECTRONIC ENGINEERS, Inc.
5528 VINELAND AVENUE
NORTH HOLLYWOOD, CALIF.
IEE

For further information mark No. 45

New products—cont.

TV antennas 165

A number of slot antennas have been supplied, or are under construction for Canadian television stations, including CFCN-TV, Calgary, CHCA-TV, Red Deer, Alta., CHAU-TV, New Carlisle, Que., CKX-TV, Brandon and JCH-TV, Halifax. Illustrated is the 8-slot, 24-gain antenna which gives CFCN-TV, Calgary, maximum power of 100 kw. with a directional pattern. It is 173 feet long.

Canadian General Electric Co. Ltd., Toronto.

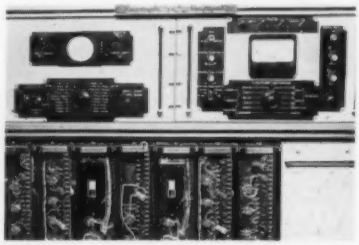
Laminated paper Mylar dipped capacitors 166

Type RDLM laminated paper/Mylar dipped capacitors utilize a construction which provides high insulation resistance, moisture resistance and reliability. Working voltages available are 200, 400, 600, 1,000 and 1,600 vdc. Tolerances are ± 10% and ± 20%; closer tolerances are available on request. Insulation is Durez phenolic resin impregnated. Operating temperature range is 100 to 125C, and capacity ratings are from 0.001 uf to 0.5 uf.

Capacitors of Canada Ltd., Toronto.

Automatic paper flaw detector 167

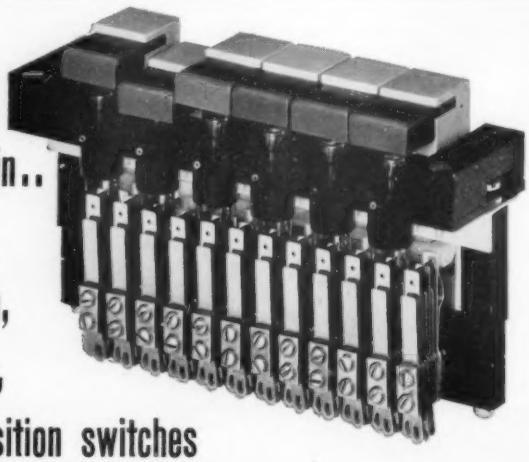
This equipment for detecting flaws in paper consists of an inspection head assembly which is mounted over one of the initial rolls of paper on the cutting machine. Lights within the inspection head flood the paper and one or more scanning arrangements (one only is required if the sheet width is less than 50 inches) scans the sheet in a transverse direction. One recent installation operates at sheet speeds up to 600 feet per minute, but equipment of this type can be designed to operate at almost any required sheet speed. The cutter must be modified to provide a sorting deflecting mechanism and an extra layboy to accommodate the rejected sheets. A memory device is also



mounted on the machine to store the information provided by the detector so that the deflector can be operated at the appropriate time to ensure the sheet containing the flaw is the one that is rejected after the cutting operation.

The inspection head assembly is con-

A NEW CONCEPT in.. illuminated, push button, interlocking, multiple position switches



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nected by means of cables to the control cabinet which contains the electronic circuitry necessary for the analysis of the signal from the scanning mechanism. The control cabinet also contains testing facilities so that relatively inexperienced operators can isolate faults and interchange modules to get the equipment back into service. Design of the equipment is based on an original development by National Research Council in cooperation with Provincial Paper Company.

Electronic Associates Ltd., Toronto.

Vernier potentiometer 168

Type 9144 is a 4-dial, 6-figure dc vernier potentiometer with linearity initially adjusted to better than 2 ppm. Stability is guaranteed to be better than 1.5 ppm per year. Precautions have been taken in the original design to reduce the importance of contact resistance of all emf dials to a position of minor significance. In addition to being a measuring potentiometer it is a resistance comparator, a saturated standard cell comparator, a precision 4-terminal, 21-ohm standard resistor, and a standard cell enclosure. Type 9144 potentiometer is based on an original design by Dr. T. M. Dauphinee of National Research Council.

Guildline Instruments Ltd., Smiths Falls, Ont.

Phonograph arm 169

The Gould low distortion phonograph arm has a base resonance below 10 cps. when used with most available cartridges. The 16-inch arm is made from a single piece of walnut wood and has a maximum tracking error of 0.4 degrees per inch. Continuous stylus pressure is adjustable from 0-20 grams and the arm tracks with pressure as low as ½ gram. Lateral tracking force required to overcome inertia is 1/10 gram.

Dalyn Industries, Montreal.

Cameron power factor bridge 170

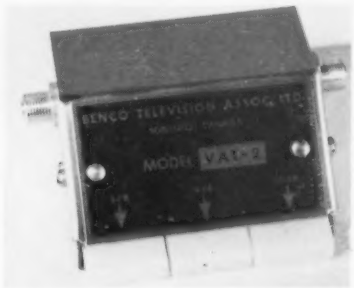
This bridge for measurement of power factor of insulation in high voltage electrical apparatus was invented by A. W. W. Cameron, P.Eng. of Ontario Hydro. Power factor measurement is an excellent method for non-destructive field testing of insulation systems to detect deterioration and permit scheduled repair before failure. The Cameron power factor bridge is a portable measuring unit which is used at the device under test and connected by cable to a portable power supply operating from 115 v., 60 cps. and having an adjustable output of 0-10 kv. A significant feature of the bridge is its construction; the measuring circuits, meter, electronic amplifier, etc. are mounted in an inner housing which is at high voltage. A high voltage bridge reference is thus provided between this inner housing and the outer grounded housing of the instrument. By means

of construction, and special control and signal circuits, a number of safety features are included.

Fischer & Porter (Canada) Ltd., Toronto.

Variable attenuator 171

Model VAT-2 push-button variable attenuator for 75 ohm coaxial cable uses three push buttons to select the following attenuations: 3, 6, 9, 14, 17, 20 and 23 db.



Benco Television Associates Ltd., Toronto.

Zener power supply 172

Model RS 40 power supply in a constant current supply for the testing of Zener diodes. It has 3 current ranges of 1-10 ma; 10-100 ma and 100 ma to 1 amp. Guaranteed minimum voltage is 13 and the ripple voltage for all

settings is less than 20 mv rms. Stability of the output current is better than 0.5% against load and/or ±20% line voltage variations.

Gomard Electronics Ltd., Hamilton.

(Continued on page 78)

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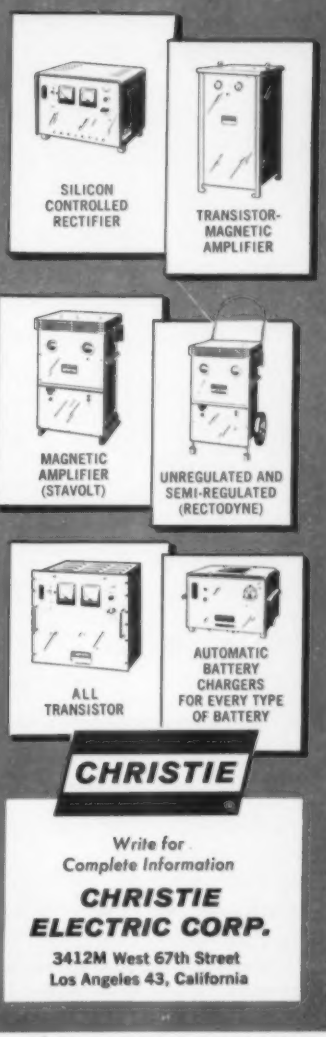

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New products—cont.

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W. H. Brady Co. of Canada Ltd., Brampton, Ont.

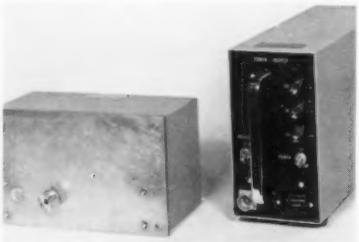
High speed tape reader 174

High speed punched tape reader type 196 is designed for a synchronized stop-start speed of 200 characters per second having start and stop times of less than 2 ms. It is capable of bi-directional operation and has a centre unwind facility which provides for the re-running of reels of tape without the necessity of rewinding. Solid state electronics are used throughout. The signal output is 10 volts at 10 ma (hole) and 0 volts (no hole).

Ferranti-Packard Electric Ltd., Toronto.

Analog to digital converter 175

Model 541 analog to digital converter is an instrument which accepts a shaft rotation input and delivers electrical outputs which express the instantaneous



angular position of the input shaft in decimal circuit form. A distinguishing feature of the converter is the use of magnetic circuits for switching. This eliminates the maintenance and operational problems usually associated with equipment incorporating contacts or light-path arrangements. The output circuits consist of four decades of 10 circuits each. Any number from 0-9999 can be represented by the presence of a voltage at the appropriate circuit position of each of the four decades. The individual digital outputs are 12 volts at 0.5 amperes and are available for application to external indicators of circuits.

George Kelk Ltd., Toronto.

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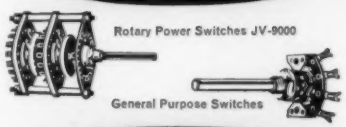

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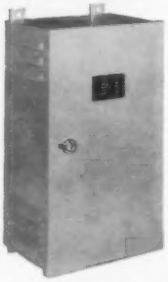

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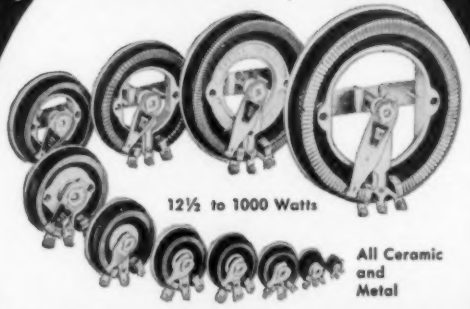

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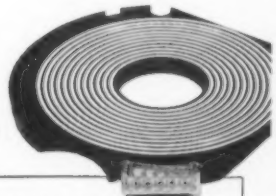

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Hon. George H. Hees will open National Production Show

The Honorable George H. Hees, Minister of Trade and Commerce, has agreed to formally open the third biennial National Industrial Production Show of Canada, to be held May 8-12, in the Industry and Coliseum Buildings, Toronto.

This Exhibition is in line with Federal Government action to establish a National Productivity Council, which will co-operate with secondary industries in order to promote productivity and thus increase employment.

Mr. Hees has declared that Canadian manufacturers should make a determined effort to produce merchandise that the home and export markets will want to buy at prices they can afford to pay.

What the Production Show will do for productivity is to provide an opportunity for plant managers and owners, technicians, engineers, supervisors and executives to examine in one place the latest improvements in industrial production equipment, study methods and techniques, and select what they can use to improve their own production.

High fidelity exposition

John R. Tilton, president of the Dominion High Fidelity Association has announced that the 1961 Toronto High Fidelity Exposition will move to the Seaway Hotel where 58 rooms and salons have been booked for the week commencing October 16. Show dates for the public will be Wednesday to Saturday, Oct. 18-21.

It is also planned to again hold an industry reception and dinner for dealers and exhibitors on Oct. 17, on the convention hall of the Seaway Hotel. Being held the night before the show opens for public viewing, it will provide an opportunity for dealers to preview the new high fidelity and stereo lines being shown and demonstrated by exhibitors.

WESCON papers

Papers are being sought for the 1961 Western Electronic Show and Convention to be held August 22-25, at San Francisco. Abstracts of 100-200 words and detailed summaries of 500-1000 words should be submitted before May 1, 1961, to Mr. E. W. Herold, Chairman, Technical Program, Western Electronic Show and Convention, 701 Welch Road, Palo Alto, California. Authors will be notified by June 1 of acceptance or rejection.

Milan trade Fair

The 39th Milan International Trade Fair is expected to attract more than the 93,000 visitors it had last year. Scheduled for April 12-27, in Milan, Italy, it will have nine main groups of exhibits, including one on electronics. Components, instruments, equipment and services will be displayed for a broad range of electronic fields. Information can be obtained from Mr. F. Slataper, Italian Trade Commissioner, Suite 403, 34 King St. East, Toronto.

Electronic components symposium

The organizing committee of the Canadian Military Electronic Components Symposium, Ottawa, April 11-12, has completed arrangements for technical papers. Mr. H. Reiche, chairman of the organizing committee, will make the opening remarks and introduce the keynote speaker, Dr. E. W. R. Steacie, President of National Research Council. Response to the guest speaker will be given by J. Key, president of Electronic Industries Association of Canada.

Session I; component research and development in Canada: Moderator is F. W. Simpson, NRC. Papers are: ECRDC — its organization, operation and program by H. Lysons, DRTE; Aluminum electrolytic capacitors, by Dr. F. J. Burger, TCC of Canada Ltd.; Semiconductor radiation detectors, by Dr. R. W. Jackson, RCA Victor Co. Ltd.; Investigation of barium titanate-based materials using x-ray techniques, by Prof. O. Knop, Nova Scotia Technical College.

Session II; components standardization: Moderator is Lt-Col. W. H Ellis, director, CAMESA. Papers are: Electronic parts specifications — current and future, H. D. Adam, division head, specifications; Qualification approval program, by J. Wilson, CAMESA; Government and industry requirements for test facilities, by E. W. Parrot, CAMESA.

Session III; components reliability: Moderator is S/L A. E. Kelly, RCAF. Papers are: A perspective view of electronic component reliability, by C. I. Soucy, RCAF; The CAMESA reliability test program, by A. P. Harris, CAMESA; Quality assurance aspects of reliable parts, by F. Preziosi, Inspection Services.

Session IV; component production: Moderator is G. C. Rowe, DDP. Papers are: The DDP reliability program, by V. E. Tant, DDP; Canada-U. S. defence production sharing, by M. L. Card, DDP; Development assistance, by T. C. Jones, DDP.

Processings of the symposium will be published and will be available free of charge.

COMING EVENTS

March

16-17 Conference on data processing problems in engineering and scientific research, sponsored by The University of Arizona, Tucson, Ariz.

20-23 IRE International Convention, New York.

21-25 Electrical Engineers (ASEE) Exhibition Ltd., Earls Court, London.

April

18-19 Conference on organic semiconductor physics. Armour Research Foundation and "Electronics", Chicago.

May

3-13 British Columbia International Trade Fair, Exhibition Park, Vancouver.

7-12 89th Society of Motion Picture and Television Engineers Convention, King Edward-Sheraton Hotel, Toronto.

8-10 National Aeronautical Electronics Conference, Dayton, Ohio.

9-17 International Exhibition on measurement, control, regulation and automation, sponsored by the French Mechanical and Electronic Manufacturers Association. Paris. France.

Broadcasting in Canada

The radio and television broadcasting industry in Canada has experienced a remarkable growth in the last few years, highlighted by the opening in recent months of several new TV stations. The April Issue of CEE will include the results of a survey of broadcast station equipment and operating practices, and other articles dealing with new developments in broadcast equipment.

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Audio, telemetry and low frequency oscillators

Pictured here are six of the most widely used oscillators in electronics. All employ the highly stable, dependable, accurate resistance-capacity circuit. They require no zero setting. Output is constant, distortion is low and frequency range is wide. Scales are logarithmic for easy reading; all are compact, rugged and broadly useful basic instruments. Brief specifications are given below; call your hp rep for demonstration or write direct for complete data on any instrument.

Model	Frequency Range	Calibration Accuracy	Output to 600 ohms	Recommended Load	Maximum Distortion	Max. Hum & Noise ¶	Input Power	Price
200AB	20 cps to 40KC (4 bands)	±2%	1 watt (24.5 v)	600 ohms	1% 20 cps to 20 KC 2% 20 KC to 40 KC	0.05%	70 watts	$165.00
200CD	5 cps to 600 KC (5 bands)	±2%	160 mw 10 volts	600 ohms*	0.5% below 500 KC 1% 500 KC and above	0.1%	75 watts	$195.00
200J	6 cps to 6 KC (6 bands)	±1%†	160 mw 10 volts	600 ohms*	0.5%	0.1%	110 watts	$350.00
200T	250 cps to 100 KC (5 bands)	±1%†	160 mw 10 volts	600 ohms*	0.5%	0.03%	160 watts	$500.00
201C	20 cps to 20 KC (3 bands)	±1%†	3 watts (42.5 v)	600 ohms**	0.5%‡	0.03%	75 watts	$250.00
202C	1 cps to 100 KC (5 bands)	±2%	160 mw 10 volts	600 ohms*	0.5%§	0.1%	75 watts	$300.00

*Internal impedance is 600 ohms. Frequency and distortion unaffected by load resistance. Balanced output with amplitude control at 100. Use line matching transformer for other control settings. **Internal impedance approximately 600 ohms with output attenuator at 10 db or more. Approximately 75 ohms below 5000 cps with attenuator at zero. †Internal, non-operating controls permit precise calibration of each band. ‡0.5%, 50 cps to 20 KC at 1 watt output. 1.0% over full range at 3 watts output. §0.5%, 10 cps to 100 KC. 1.0%, 5 to 10 cps. 2.0% at 2 cps. 3.0% at 1 cps. ¶Measured with respect to full rated output.

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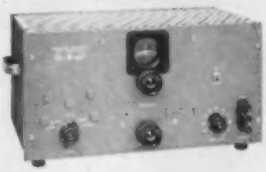
Audio Oscillator

hp 200CD
Wide Range Oscillator

hp 200J
Interpolation Oscillator



hp 200T
Telemetry Oscillator

hp 201C
Audio Oscillator

hp 202C
Low Frequency Oscillator

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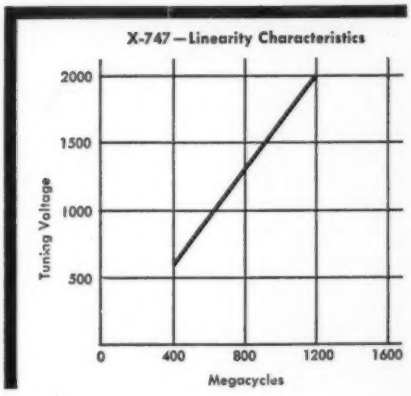

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